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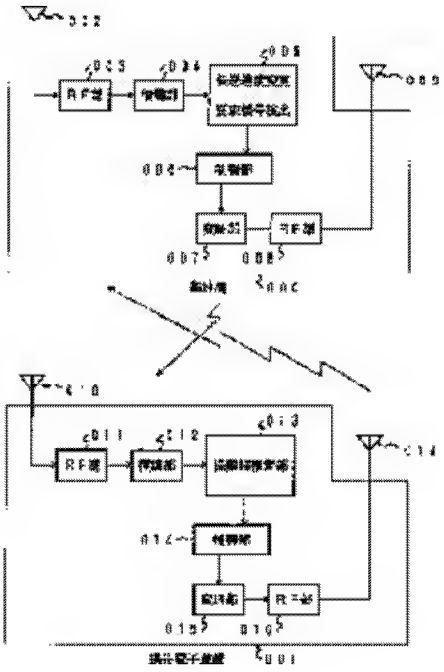
(54) RADIO COMMUNICATION SYSTEM



(57)Abstract:

PURPOSE: To secure the transmission quality of a down link and simplify the constitution of a portable electronic device.

CONSTITUTION: The transmission rate change request signal detection part 005 of a base station 000 extracts a signal requesting a change in the signal transmission rate (signal transmission rate of down link) at the time of the transmission of a signal from the base station 000 to the portable electronic device 001, and performs operation for changing the signal transmission rate of the down link. A modulation part 007 changes the signal transmission speed and outputs a modulated signal to the portable electronic device 001. A propagation path estimation part 013 estimates a propagation path between the base station 000 and portable electronic device 001 and outputs the estimation result to a

control part 014. The control part 014 judges whether or not the signal transmission rate of the down link is changed from the output of the propagation path estimation part 013 and generates and outputs a change request signal to a modulation part 015 when the transmission rate is changed.

CLAIMS

[Claim(s)]

[Claim 1]A radio communications system possessing an access speed variable means characterized by comprising the following to which said base station makes access speed of a down-link variable in a radio communications system containing a radio transmission system.

A portable electronic device provided with radio equipment.

A base station which performs said electronic portable instrument and radio via an uplink circuit of a signal-transmission speed [low speed / speed / of said down-link circuit for receiving a signal from a down-link circuit and said portable electronic device, in order to transmit a signal to this portable electronic device / signal-transmission].

[Claim 2]Provide said portable electronic device based on a radio signal transmitted from said base station to said portable electronic device, and an estimation means which presumes a radio propagation situation with said base station said base station, The radio communications system according to claim 1 determining access speed of said down-link and changing access speed of said down-link by said access speed variable means based on a radio propagation situation acquired by said estimation means.

[Claim 3]The radio communications system according to claim 1 which is provided with the following and characterized by transmitting a demand which changes a down-link from said portable electronic device to access speed determined by said determination means to said base station with a radio signal.

An estimation means which presumes a radio propagation situation with said base station based on a radio signal with which said portable electronic device is transmitted from said base station to said portable electronic device.

A determination means to determine access speed of said down-link from a radio propagation situation acquired by said estimation means.

[Claim 4]Said base station changes access speed of said down-link for every period decided beforehand, The radio communications system according to claim 1 said portable electronic device's notifying the maximum access speed that reception with said access speed can judge whether it is made correctly, and can receive in access speed which changed to said base station, and determining access speed of said down-link.

[Claim 5]Beforehand, between said base station and said portable electronic device, access speed of said down-link is determined discretely, and said portable electronic device, An error detection means to detect a transmission error situation of a radio signal transmitted to said portable electronic device from said base station, Provide a means to determine access speed of said down-link according to a transmission error situation acquired from said error detection means, and said portable electronic device, The radio communications system according to claim 1 performing a demand which changes access speed to said base station according to access speed of said down-link for which it opted.

[Claim 6]The radio communications system according to claim 1 characterized by ****** by which said base station inserts a known signal for transmission-line

presumption in a radio signal over said portable electronic device periodically.

[Claim 7]A portable electronic device comprising provided with radio equipment, Via an uplink circuit of a signal-transmission speed [low speed / speed / of said down-link circuit for receiving a signal from a down-link circuit and said portable electronic device, in order to transmit a signal to this portable electronic device / signal-transmission]. A radio communications system containing a radio transmission system which consists of said electronic portable instrument and a base station which performs radio.

A receiving set from which said portable electronic device changes into a coding row a radio signal transmitted from a base station including an error correcting code-ized device coded using numerals to which redundancy signals for said base station to correct an error of an information signal transmitted to a portable electronic device were added.

An error correction decoding device which decodes a coding row obtained by said receiving set, and performs an error correction.

A redundancy **** device which removes redundancy signals of a coding row obtained by said receiving set, and outputs an information signal.

A transmission-quality estimating device which presumes the transmission

quality of a transmission line where a radio signal which said receiving set received was transmitted, When judged with the transmission quality presumed by said transmission-quality estimating device being inferior to reference quality, said symbol string is processed with said error correction decoding device, An error correction system which comprised a switching means changed so that it may process by said redundancy stripper, when judging that said transmission quality fulfills reference quality.

[Claim 8]A portable electronic device provided with radio equipment.

A base station which performs said electronic portable instrument and radio via an uplink circuit of a signal-transmission speed [low speed / speed / of said down-link circuit for receiving a signal from a down-link circuit and said portable electronic device, in order to transmit a signal to this portable electronic device / signal-transmission].

Are the above the communications system which it had and said base station, Have an error correcting code-ized device which error-correcting-code-izes a radio signal transmitted to said portable electronic device, and said portable electronic device, An error correction decoding device which carries out error

correction decoding of the error-correcting-code-ized radio signal, It has a transmission-line-quality estimating device which presumes transmission line quality of a transmission line where a radio signal was transmitted, When judged with the transmission quality being inferior to reference quality with said transmission-quality estimating device of said portable electronic device, An error-correcting-code-ized radio signal by said error correcting code-ized device is transmitted, and it decrypts with said error correction decoding device, and when it judges that the transmission quality fulfills reference quality, error correcting code-ization is not performed but said error correction decoding device is suspended.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]A portable electronic device this invention rather than the uplink transmission speed which transmits a signal to a base station. Uplink

transmission speed and down-link access speed with the more nearly high-speed down-link access speed with which said base station transmits a signal to said portable electronic device are applied to an unsymmetrical radio communications system, and make the down-link more nearly high-speed than uplink, It is related with the radio communications system which transmitted a lot of information to the portable electronic device from the base station by the information transmission demand of a small quantity of a portable electronic device.

[0002]

[Description of the Prior Art]In radio, "the transmission characteristic analysis of a symbol rate and an abnormal-conditions multi valued number variable adaptive modulation method" of Shingaku Giho RCS94-64 (1994-09) and pp.31-36 is mentioned as a conventional example of the transmission system characterized by variable access speed. In the above-mentioned literature, the method which changes an abnormal-conditions multi valued number and a symbol rate to the basis of the constraint of keeping the transmission quality constant, according to a transmission line state is indicated. Since the multiplex mode is made into TDMA/TDD, the radio signal outputted to the portable

electronic device and the radio signal outputted to the base station from the portable electronic device receive the same transmission line change from a base station. In the transmission line state estimating part of a base station, instant C/N is calculated using this reversibility, and transmission-line presumption is performed. Since a multiplex mode is TDMA/TDD in this method, in a base station, transmission-line presumption is possible. Conversely, a system applicable since the multiplex mode will be limited if it says will be restricted.

[0003]The kind of access speed in the above-mentioned literature which can be selected is shown in drawing 33. Change of a multi valued number is QPSK, 16QAM, 64QAM, and 256QAM. Change of a symbol rate is 8 ksymbol/s, 16 ksymbol/s, 32 ksymbol/s, and 64 ksymbol/s. thus, the signal-transmission speed of the system which transmits by radio conventionally -- at most -- they are tens ksymbol/s.

The frequency band to occupy is also about tens of kHz.

[0004]Transmission-line distortion is generated by a multipass or phasing. A multipass happens in order to add the ingredient in which the propagation path

between a base station and a portable electronic device carried out multiplex transmission not only with the ingredient which reaches directly but with the building. The delayed wave component by multiplex transmission is independently generated in a fixed value to change of signal-transmission speed. Therefore, the influence of the transmission-line distortion by a multipass becomes severe as signal-transmission speed becomes high-speed. When trying to perform high-speed transmission under multipath environment, it is necessary to use a usually very complicated and large-scale adaptive equalization circuit.

[0005]By the way, there is a method using the error correcting code as a method which secures the high transmission quality and improves the reliability of information and telecommunications. In the communication using an error correcting code, the signal coded by coding equipment by the transmitting information side is decoded with the decoding device of a receiver. There is satellite communication as an example of the communication using an error correcting code. In health communication, in order to stop the electric power which the satellite itself consumes, error correction technique is used. The various error correcting codes for using for various application are developed.

[0006]It is necessary to press down power consumption at the transmitting side (satellite) like satellite communication. In the receiver (base station) which is on the ground, as a matter of fact, when [that there was a power difference clearly] there were no restrictions about electric power, coding equipment had become easy composition so that power consumption might decrease, and though power consumption of a decoding device increased, even when it was complicated, it was satisfactory.

[0007]In usual, the information and telecommunications which used the error correcting code require time and effort for decoding processing. When it thinks theoretically, decoding processing is operation of correcting the received code, there being a huge table which put in order all the possible received codes and the information code corresponding to this, and referring to this table. It has come to be able to do decoding processing efficiently (rather than pulling a table) actually using structure with a table. In order to heighten error correction capability, it is necessary to lengthen code length but, if code length is lengthened, complication of a processing unit and increase of power consumption will be imitated, and it is **. When performing high speed processing, pipeline processing must be performed using two or more error

correction systems, but it means that this prepares many error correction systems of the same structure, and power consumption becomes large further.

[0008]In the communications system using the conventional error correction system, irrespective of the quality of a transmission line, an error correction decoding device is always operated and the information and telecommunications using an error correcting code are performed. That is, it means operating, though transmission line quality is good and an error correction is unnecessary, and the device which consumes much electric power is made to operate vainly. By the way, the demand of the mobile communications which use the portable electronic device "anyone can communicate always anywhere" in recent years is increasing. Furthermore, multimedia ["which can be communicated anything"] formal ** is also capturing the spotlight. That is, in the former, when a portable electronic device was used, it was mainly audio communication, but in recent years, the information and telecommunications of various gestalten, such as text, picture information, and moving image information, come to be performed besides a sound, and the demand to communicative reliability is increasing. furthermore -- "-- always -- anywhere -- anyone -- " -- "anything" -- the united multimedia type mobile

communications can also be considered and it is possible that the demand to communicative reliability increases further.

[0009]A situation contrary to the satellite communication mentioned above produces the problem of the reliability in the portable electronic device of multimedia type mobile communications. That is, in that communication which used the error correcting code is performed, in order to improve communicative reliability, although it is the same, the relation of the power which can be consumed is reversed. A portable electronic device has restrictions in the electric power which can be consumed for a small weight saving, and cannot consume power great for an error correction. In this case, a transmitting station is a base station and there are few restrictions about power consumption compared with a portable electronic device.

[0010]That is, the demand to communicative reliability is increasing further in the situation where the restriction about electric power is severer.

[0011]

[Problem(s) to be Solved by the Invention]Thus, in the conventional radio, when the down-link from a base transceiver station to a portable electronic device was constituted from fixed access speed, for example, it tried to have performed

high-speed transmission of about 150 Mbps, there was a problem that it could not communicate at all, at the place where a multipass exists. When the circuit design was performed in consideration of the multipass, only the low-speed link could be realized, but only low-speed transmission was able to be performed also at the place where a multipass does not exist. When trying to perform high-speed transmission under multipath environment, a very complicated and large-scale adaptive equalization circuit will be used, and it had become the miniaturization of a terminal (portable electronic device), and an obstacle of low power consumption.

[0012]In the portable electronic device of the multimedia type mobile communications which perform information and telecommunications using an error correcting code, although the restrictions about power consumption were large, there was a problem that the demand to reliability was high. Therefore, after securing high reliability, the radio communications system which can reduce the power consumption of a portable electronic device was demanded.

[0013]The place which this invention was made in consideration of the above situations, and is made into the purpose, The error generated in the signal transmitted to a portable electronic device from a base station is decreased, It is

providing the radio communications system which the whole transmission efficiency's is raised securing the high transmission quality in a down-link irrespective of the existence of a multipass, and can simplify composition of a portable electronic device further.

[0014]The purpose of this invention is to provide the radio communications system which power consumption is reduced, and composition of a simple portable electronic device is enabled, and can raise the whole transmission efficiency, securing the high transmission quality using an error correcting code.

[0015]

[Means for Solving the Problem]In order to solve the above-mentioned problem, in a radio communications system in this invention, it is characterized by making access speed of a down-link variable independently in a radio communications system with unsymmetrical access speed of a down-link and access speed of uplink.

[0016]In a radio communications system of variable access speed currently performed conventionally. Since a multiplex mode is TDMA/TDD, it is assumed even from which direction of communication to a portable electronic device from a base station, and communication to a base station from a portable electronic

device that a radio propagation characteristic between portable electronic devices shows the almost equivalent characteristic from a base station. However, when a system which will be the requisite is a radio communications system with unsymmetrical access speed, a radio propagation characteristic between a base station and a portable electronic device cannot carry out transmission-line presumption in a base station rather than is [therefore] reversible. Thus, in a method as which a base station of a conventional example determines access speed, variable access speed is unrealizable.

[0017]So, in this invention, a portable electronic device has a means to presume a radio propagation situation with a base station, a radio propagation situation acquired by the estimation means is transmitted to a base station with a radio signal, and it is characterized by changing access speed of a down-link in a base station.

[0018]A means by which a portable electronic device presumes a radio propagation situation with a base station, It has a means to determine access speed of a down-link from a radio propagation situation acquired by said means, and a portable electronic device is characterized by transmitting a demand to which access speed of a down-link is changed with a radio signal to a base

station.

[0019]In order to use a radio-wave-propagation situation from a base station to a portable electronic device as an index at the time of changing access speed of a down-link, it is necessary to provide a circuit which determines the maximum access speed from a result obtained by performing transmission-line presumption to a portable electronic device. However, it is needed that composition of a portable electronic device is simple as mentioned above.

[0020]In order to fill this conflicting requirement, in this invention, a base station is characterized by a thing which were decided on beforehand and for which access speed of a down-link is changed for every period, the maximum access speed that can receive a portable electronic device is notified with a radio signal to said base station, and access speed of said down-link is opted.

[0021]A changing method which was decided beforehand and to which access speed of a down-link is changed for every period is characterized by making it change from high-speed access speed to access speed [low speed one by one].

[0022]There are few amounts of signal transmissions from a portable electronic device to a base station than the amount of signal transmissions which can be transmitted to a portable electronic device from a base station in a radio

communications system with unsymmetrical access speed. Therefore, as much as possible little transmission quantity of uplink is wanted for there to be.

[0023]Then, in a radio communications system with which access speed of a down-link is beforehand determined discretely between said base station and said portable electronic device in this invention, A means by which said portable electronic device detects an error from said base station to a signal transmitted on radio to said portable electronic device, A means to determine access speed of said down-link according to a transmission error situation acquired from said means is provided, and said portable electronic device is characterized by performing a demand which gathers one step of access speed, or lowers it one step to said base station.

[0024]As for useless communication whose reception becomes impossible from a viewpoint of effective use of a channel in a portable electronic device, not existing is desirable. When a line characteristic is changed by shadowing etc. and the transmission quality deteriorates, a base station and a portable electronic device set up carry out signal-transmission speed of a down-link to communication quality being improved late. Even if it communicates with the minimum access speed, when communication quality cannot be secured,

operation which makes access speed slow will become useless.

[0025]Then, in a radio communications system as which access speed of said down-link is beforehand determined by Hazama of said base station and said portable electronic device in this invention, When said signal-transmission speed decided beforehand is [access speed of a down-link] a low-speed thing most and a demand is advanced so that said portable electronic device may make access speed of a down-link a low speed further, communication to said portable electronic device from said base station is intercepted.

[0026]Since access speed of a down-link is a high speed in a communication main-actor-in-a-No-play sum with unsymmetrical access speed, transmission capacity to a portable electronic device is large compared with uplink from a base station. Therefore, it is possible to insert a known signal for transmission-line presumption frequently.

[0027]So, in this invention, said base station device is characterized by inserting a known signal for transmission-line presumption in communication to said portable electronic device from said base station periodically.

[0028]By a communication method of the conventional variable access speed, it is assumed as an access method that TDMA/TDD mentioned above. Therefore,

when changing access speed of a signal according to a transmission line state, access speed of uplink and access speed of a down-link are changed simultaneously. Since transmission-line presumption was possible in a base station, it was possible to have changed access speed only by a base station notifying change of access speed. However, when transmission-line presumption is impossible in a base station, access speed cannot be determined in a base station independent.

[0029]In this invention, on a basis a radio propagation situation acquired by said estimation means Then, said base station. Or said base station and said portable electronic device are characterized by determining timing to which signal-transmission speed is changed using a control channel by which said portable electronic device made a decision to which access speed of said down-link is changed, and was prepared for said down-link and said uplink.

[0030]It comprises a portable electronic device provided with radio equipment, and a base station which a radio signal from said portable electronic device is received, and transmits information to said portable electronic device with a radio signal, In a radio communications system whose down-link access speed to which said base station transmits a signal to said portable electronic device is

more nearly high-speed than rise ring access speed to which said portable electronic device transmits a signal to said base station, A receiving set from which a signal showing a symbol string error-correcting-code-ized using numerals which can acquire an information series only by said portable electronic device removing redundancy is transmitted by a radio signal, and changes this signal transmitted into a symbol string, An error correction decoding device which decodes said symbol string obtained by said receiving set, and performs an error correction, A redundancy **** device which removes and decodes only redundancy without carrying out the error correction of said symbol string obtained by said receiving set, When judged with the transmission quality presumed by transmission-quality estimating device which presumes the transmission quality of a transmission line where a radio signal which said receiving set received was transmitted, and said transmission-quality estimating device being inferior to reference quality, said symbol string is processed with said error correction decoding device, An error correction system which comprised a switching means changed so that it may process by said redundancy stripper, when judging that said transmission quality fulfills reference quality was provided.

[0031]The error correction system can control selection of processing of said symbol string, i.e., selection of said error correction system and said redundancy stripper, from an external device besides presumption of the transmission quality by a transmission-quality estimating device.

[0032]Even when it has error detection equipment which can detect that an error is contained in said symbol string and a transmission-quality estimating device has chosen a redundancy stripper, it is an error correction system detecting an error with said error detection equipment.

[0033]some gestalten are among information transmitted and said information is most suitable according to a gestalt of information out of two or more error correcting codes -- it being error-correcting-code-ized and, It is an error correction system having two or more decoding devices corresponding to said error correcting code, and choosing a decoding device from said decoding devices according to a gestalt of said information.

[0034]It comprises a portable electronic device provided with radio equipment, and a base station which a radio signal from said portable electronic device is received, and transmits information to said portable electronic device with a radio signal, In a radio communications system whose down-link access speed

to which said base station transmits a signal to said portable electronic device is more nearly high-speed than rise ring access speed to which said portable electronic device transmits a signal to said base station, Have said base station and an error correcting code-ized device which error-correcting-code-izes a radio signal transmitted to said portable electronic device said portable electronic device, An error correction decoding device which carries out error correction decoding of the error-correcting-code-ized radio signal, It has a transmission-line-quality estimating device which presumes transmission line quality of a transmission line where a radio signal was transmitted, When judged with the transmission quality being inferior to reference quality with said transmission-quality estimating device of said portable electronic device, An error-correcting-code-ized radio signal by said error correcting code-ized device is transmitted, and it decrypts with said error correction decoding device, and when it judges that the transmission quality fulfills reference quality, error correcting code-ization is not performed but said error correction decoding device is suspended.

[0035]A radio communications system using an error correction, A transmission rate is raised with embedding information without suspending an error correction

system, and notifying non-use of an error correction system to a transmitting station which performs error correcting code-ization and performing error correcting code-ization by the transmitting station side, when judging that said transmission quality fulfills reference quality.

[0036]A transmitting station has two or more error correcting code-ized devices which process a different error correcting code, A receiving station has two or more error correcting code-ized devices which a transmitting station has, and two or more corresponding error correction decoding devices, A receiving station presumes the transmission quality with said transmission-quality estimating device, and according to the transmission quality, An error correction decoding device which was most suitable with said two or more error correction decoding devices is chosen, Report to a transmitting station which error correction decoding device is used, and it determines to use an error correcting code corresponding to an error correction decoding device which the receiving station side uses in the transmitting station side, In the receiving station side which notified the receiving station side that an error correcting code-ized device to be used was changed and an error correcting code-ized device was changed, and received a notice, it is a radio communications system changing an error

correction decoding device.

[0037]It is a communications system using an error correction system, wherein a receiving station notifies presumption of the transmission quality by said transmission-quality estimating device to a transmitting station and the transmitting station side chooses an error correcting code to be used.

[0038]

[Function]By this invention, in a radio transmission system with unsymmetrical access speed, it becomes possible to set it as the fastest signal-transmission speed under the radio propagation situation from a base station to a portable electronic device, and it can improve synthetic transmission capacity (throughput).

[0039]The principle of this invention is explained based on the example in which multipass distortion changed in the transmission line from a base station to a portable electronic device exists. In order to make the access speed of a down-link high-speed in this radio communications system, under multipath environment, many errors occur in a transmission signal. In a portable electronic device, based on the signal transmitted by radio from a base station, the radio propagation situation from a base station to a portable electronic device is

presumed, and the fastest access speed that can be transmitted is determined in a portable electronic device or a base station from the presumed result. It is required that a portable electronic device should lower signal-transmission speed when the propagation situation between a base station and a portable electronic device is bad. If access speed is lowered, the amount of signal transmissions which can be transmitted in unit time will be reduced, but the error of a transmission signal decreases.

[0040]When a radio propagation situation is bad, ARQ is performed in order to compensate a digital error. That is, ARQ is frequently performed by many digital errors. A throughput decreases from this. In this invention, signal-transmission speed is reduced and it becomes possible by improving a noise characteristic-proof to reduce generating of a digital error. As mentioned above, the amount of information transmissions itself decreases by reducing signal-transmission speed, but synthetic transmission capacity improves by reduction of ARQ generating by a digital error decreasing.

[0041]Conversely, when there is little influence by multipass distortion, sufficient performance is not obtained with fixed access speed. In spite of being able to transmit this with higher access speed, it is for transmitting at a low speed

immobilization signal-transmission speed. When it is judged that it is possible to observe a radio propagation situation in a portable electronic device, and also to raise signal-transmission speed in this invention, it is required that signal-transmission speed should be gathered to a base station. In response to this requirement signal, processing which gathers the signal-transmission speed of a down-link is performed in a base station. By the above method, it becomes possible to transmit the maximum rate according to the transmission line state, and total access speed can be gathered.

[0042]In order to change the access speed of a down-link by communication about change of the access speed of a portable electronic device and a base station, also in access methods other than TDMA/TDD which cannot perform transmission-line presumption by a base station side, variable access speed can be realized and a synthetic throughput improves.

[0043]Since the access speed of the down-link for which it opted beforehand is changed in time, the optimal signal-transmission speed can be easily found with a portable electronic device, and, thereby, portable electronic device ********** can be simplified.

[0044]It becomes possible [the access speed of uplink] by determining

changing signal-transmission speed between a base station and a portable electronic device, and change timing by a control channel to change only the access speed of a down-link.

[0045]In order to secure the high transmission quality and to improve the reliability of information and telecommunications, there are the following operations in the radio communications system which performs communication which used the error correcting code.

[0046]In a situation with the sufficient transmission quality, since an error correction is not required, it is not operating the error correction system highly attached in respect of power consumption, and power consumption is not necessarily reduced.

[0047]It enables it to control selection of an error correction decoding device and a redundancy stripper also from other than a transmission-quality estimating device. For example, since the remainder of the electric power which is accumulating the terminal has decreased and some errors may be permitted, a user can choose not operating an error correction system compulsorily for information to come to hand to the last.

[0048]Since it becomes possible by detecting existence of an error with error

detection equipment to correct an error by resending or other means even when the error correction system is not making it operate for reduce power consumption and an error happens, it is guaranteed about high reliability. Since circuit structure is also smaller than an error correction system and error detection equipment generally has little power consumption, compared with the case where the error correction system is always operated, it becomes possible to cut down power consumption.

[0049]Efficient communication can be performed by supposing that it is possible to choose from from the error correction decoding device which is most suitable according to the gestalt of information while more than one were prepared.

[0050]Since an error correction is performed when the transmission quality is bad, reliable transmission can be performed, since an error correction is not performed when the transmission quality is good, power consumption is held down, and it becomes possible to raise a transmission rate further compared with the case where an error correction is performed.

[0051]Since information is embedded into the redundant portion of an error correcting code, since the length of a symbolic language does not change, it has seemingly the feature that a device becomes easy.

[0052]Since most suitable numerals can be chosen according to the transmission quality out of two or more error correcting codes, consumption of electric power can be held down and communicative efficiency can be gathered.

[0053]Although the receiving station side performs presumption of the transmission quality, since the transmitting station side determines what kind of operation is performed based on an estimation result, a receiver does not need to have a circuit, electric power, etc. which are needed for determination, and it becomes saving of circuit structure, power consumption, etc. When determining, in the transmitting station side, not only the report by the side of a receiving station but other various information can be used. For example, when the position and the transmission quality of a receiving station have correlation like an electric wave, in the transmitting station side, the accuracy of presumption about the transmission quality can be raised more by making and placing the database about a position and the transmission quality.

[0054]

[Example]Hereafter, the example of this invention is described with reference to drawings. Drawing 1 is a figure showing the composition of the data communication system using the radio communications system by this invention.

The radio communications system by this invention is constituted by the portable electronic device provided with radio equipment, and the base station which the radio signal from a portable electronic device is received, and transmits information to a portable electronic device with a radio signal.

[0055]The radio transmission system which performs radio between a base station and a portable electronic device, The down-link access speed which signal-transmission speed receives asymmetry, and the base station 12 receives a portable electronic device, and transmits a signal, It is an SDL (Super high speed DownLink) system more nearly high-speed than the uplink transmission speed which transmits a signal from the portable electronic device 10 to the base station 12. Here, down-link transmission is a short range (the down-link of a wide area may occur), and uplink transmission serves as a wide area.

[0056]For example, a base station uses a high bandwidth signal for down-link transmission, and provides service (multimedia service) of the communication including a picture, a sound, a file editing, information distribution and public relations, broadcast, etc., etc. to a portable electronic device. A portable electronic device uses a narrow band signal for uplink transmission, and, in the case of the information which controls a down-link, and selection of a channel

and multimedia, a control signal, voice data, etc. which choose media are transmitted to a base station.

[0057]When two or more portable electronic devices exist in the area (it can communicate between portable electronic devices) which a base station covers, the circuit of uplink and a down-link is established to each portable electronic device in the possible range.

[0058]The base station is connected with the network, for example.

Service which was mentioned above via the network is acquired according to the demand from a portable electronic device, etc., and it provides for a portable electronic device.

As shown in drawing 1, a terminal (not shown) besides database system and various control systems etc. other than two or more base stations is connected to the network.

Transmission and reception of information are possible to mutual.

The portable electronic device can use the variety-of-information service through a network using the radio transmission system between base stations.

[0059]In an SDL system, in order to realize multimedia service which provides arbitrary information from arbitrary points to a portable electronic device, it can

be necessary to transmit a lot of data from a base station to a portable electronic device. Therefore, it is desired for the access speed of a down-link to be high-speed as much as possible. It is desired for a portable electronic device to be small as much as possible. The miniaturization of a portable electronic device is realized by sacrificing signal-transmission speed from a portable electronic device to a base station.

[0060]A high-speed down-link is used and adoption of a TDD system is considered in the multimedia radio communications system which provides a portable electronic device with various information from a base station. The distance of a base station and a mobile station is arbitrary, therefore the transmission from a mobile station and the transmission from other mobile stations are the purposes of making it not collide with the transmission from a base station, and the section blank in time called guard time is established in the upstream of a TDD system.

[0061]Such a multimedia radio communications system assumes the very high-speed circuit. The time by this guard time means that the time which can transmit an information signal decreases, and becomes the cause of reducing total access speed. When a TDD system is used, a base station and a portable

electronic device need to use the same frequency band and signal-transmission speed. However, these restrictions apply a great burden to the transmitter of a portable electronic device, and make difficult realization of the miniaturization of the portable electronic device which constitutes a portable electronic device, and low power consumption.

[0062]In an SDL system, since it is a high speed, it is more difficult than the access speed of uplink of the access speed of a down-link to adopt TDMA/TDD as a multiplex mode. Therefore, taking advantage of the characteristic of TDD, it will be said like a conventional system that a base transceiver station cannot presume a transmission line between a base station and a portable electronic device directly. Although it is required for a portable electronic device that composition should be simple as much as possible, that transmission-line presumption cannot be performed in a base station is a factor which checks the demand of this simplification.

[0063]In a wireless communication system with unsymmetrical access speed like an SDL system. Rather than the uplink transmission speed to which said portable electronic device transmits a signal to a base station, since the down-link access speed to which a base station transmits a signal to a portable

electronic device is a high speed, To the signal transmitted from a base station to a portable electronic device, it has the problem of becoming easy to generate an error.

[0064]However, in the access speed of about tens of ksymbol/s performed conventionally, it did not become a problem. A down-link follows at high speed, and appears notably, and the influence of the transmission-line distortion by a multipass also becomes a factor which checks the transmission quality of a down-link. When a radio communications system with unsymmetrical access speed performs multimedia service, the access speed of a down-link is the maximum and a means for becoming about hundreds of Msymbol/s to also be assumed and to compensate the error by transmission-line distortion also from this is required.

[0065]In the wireless communication system of the variable access speed currently performed conventionally. The access speed of uplink and a down-link is comparable, and since a multiplex mode is TDMA/TDD, the radio propagation characteristic between a base station and a portable electronic device shows the almost equivalent characteristic even from which direction of the communication to a portable electronic device from a base station, and the communication to a

base station from a portable electronic device. However, when the system which will be the requisite is a wireless communication system with unsymmetrical access speed, the radio propagation characteristic between a base station and a portable electronic device cannot carry out transmission-line presumption in a base station rather than is [therefore] reversible. Thus, application of the conventional system to the unsymmetrical wireless communication system with which single or more figures access speed like an SDL system differs was difficult.

[0066]Hereafter, the concrete composition which solves these problems is explained.

[0067]First, the radio communications system concerning the 1st example of an invention is explained according to drawing 2. The radio communications system of the 1st example can make the access speed of a down-link variable. Drawing 2 is a block diagram showing the composition of the base station 000 and the portable electronic device 001 of a radio communications system in the 1st example.

[0068]Although the one base station 000 and the one portable electronic device 001 are shown by drawing 2, When many portable electronic devices exist to

one base station in addition to communication of a base station and a portable electronic device of 1 to 1 and two or more base stations exist to one portable electronic device, the case where two or more base stations and two or more portable electronic devices exist can be considered. Since the composition same in any case is taken, in order to explain simply, the case where many one portable electronic devices 001 exist per base station 000 is made into an example, and it explains here.

[0069]The base station 000 is constituted by the antennas 002 and 009, RF sections 033 and 008, the demodulation section 004, the access speed change-request signal detection part 005, the control section 006, and the modulation part 007. The portable electronic device 001 is constituted by the antennas 010 and 017, RF sections 011 and 016, the demodulation section 012, the propagation path estimation part 013, the control section 014, and the modulation part 015.

[0070]In the base station 000, after being received by the antenna 002 and amplifying the signal from the portable electronic device 001 by RF section 003, it gets over by the demodulation section 004. From the output signal of the demodulation section 004, the access speed change-request signal detection

part 005 extracts the signal which requires change of the signal-transmission speed at the time of transmitting a signal to the portable electronic device 001 (signal-transmission speed of a down-link) from the base station 000, and outputs it to the control section 006. The signal which requires change of the signal-transmission speed of a down-link is transmitted from the portable electronic device 001. The control section 006 performs operation of changing the signal-transmission speed of a down-link, according to the output of the access speed change-request signal detection part 005. With the output of the control section 006, the modulation part 007 changes signal-transmission speed, and outputs a modulating signal to the portable electronic device 001. In RF section 008, the modulating signal which is an output from the modulation part 007 is amplified, and it transmits from the antenna 009.

[0071]In the portable electronic device 001, after being received by the antenna 010 and amplifying the signal transmitted from the base station 000 by RF section 011, it gets over by the demodulation section 012. The propagation path estimation part 013 presumes the propagation path between the base station 000 and the portable electronic device 001 from the output of the demodulation section 012, and an estimation result is outputted to the control section 014. In

the control section 014, in judging whether the signal-transmission speed of a down-link is changed from the output of the propagation path estimation part 013 and changing access speed, a change-request signal is created and it outputs to the modulation part 015. The modulated wave which is an output of the modulation part 015 is amplified by RF section 016, and is transmitted from the antenna 017.

[0072]By the above composition, the signal-transmission speed of the down-link to the portable electronic device 001 can be changed from the base station 000.

[0073]Next, the radio communications system concerning the 2nd example of this invention is explained according to drawing 3. In the radio communications system which comprises a base station and a portable electronic device, drawing 3 shows the composition by the side of the portable electronic device 10 for deciding the access speed of the down-link from a base station. In the 2nd example, a base station side determines the access speed of a down-link.

[0074]The portable electronic device 10, The receiving antenna 11 and radio signal which receive the radio signal transmitted to the portable electronic device are chosen from a base station (not shown). Receiving RF section 12 and RF signal which carry out RF amplification. The low pass filter 15 for removing the

unnecessary image after mixing by the variable frequency oscillator 13 which is a local oscillator for changing into a baseband signal, the mixer 14 which mixes the output of receiving RF section 12, and the output of the variable frequency oscillator 13, and the mixer 14, A known signal portion is detected from the data signal to which it restored by the demodulation section 16 which commits the modem which restores to the output of the low pass filter 15 to a data signal, and the demodulation section 16, By taking correlation with the output of the known signal primary detecting element 17 and the known signal primary detecting element 17 and known signal which take out a known signal portion. Transmission line information. The output of the correlator 18 and the correlator 18 to obtain. The output of the memory 19 to buffer, the transmission-line estimation data preparing part 20 which creates the transmission-line estimation data to a base station, the control section 21 which controls the correlator 18, the memory 19, and the transmission-line estimation data preparing part 20, and the transmission-line estimation data preparing part 20. The low pass filter 23 for band-limiting and shaping in waveform the output of the modulation part 22 changed into a baseband signal, and the modulation part 22, The unnecessary image after the variable frequency oscillator 24 which is a local oscillator for

carrying out upconverting to RF, the mixer 25 which mixes the output of the low pass filter 23 and the output of the variable frequency oscillator 24, and mixing is removed, It comprises the transmission antenna 27 which emits the radio signal acquired by amplification by transmitting RF section 26 and transmitting RF section 26 which amplify an RF signal to an output level to a base station.

[0075]In the portable electronic device 10, to the data signal to which it restored by the demodulation section 16, the known signal primary detecting element 17 detects the timing of the known signal included in the data signal, and notifies to the control section 21. The control section 21 to which known signal timing was notified operates the correlator 18 and the memory 19. Simultaneously with detection of known signal timing, in the known signal primary detecting element 17, a known signal portion is taken out from the data signal to which it restored. In the correlator 18, correlation of the known signal used as the known signal portion to which it restored, and the reference which it has with the portable electronic device 10 is taken, and a result is outputted to the memory 19. Since a correlation output changes with transmission line states, the base station which is not illustrated performs operation which determines the access speed of the optimal down-link from the output of this correlator 18. The portable electronic

device 10 has transmitted the correlation output held at the memory 19 as information for a base station to determine access speed to a base station.

[0076]A base station can acquire information for the above composition to determine the signal-transmission speed of a down-link, and it becomes possible to communicate with the optimal access speed.

[0077]Next, the radio communications system concerning the 3rd example of this invention is explained according to drawing 4. In the radio communications system which comprises a base station and a portable electronic device, drawing 4 shows the composition by the side of the portable electronic device 10 for deciding the access speed of the down-link from a base station. In the 2nd example, although the access speed of the down-link was determined by the base station side, in the 3rd example, it carries out in the portable electronic device 10.

[0078]The portable electronic device 10 in drawing 4 attaches identical codes about the portion equivalent to the portable electronic device 10 shown in drawing 3. The portable electronic device 10 of the 3rd example, The receiving antenna 11, receiving RF section 12, the variable frequency oscillator 13, the mixer 14, the low pass filter 15, the demodulation section 16, the known signal

primary detecting element 17, the correlator 18, the memory 19, the modulation part 22, the low pass filter 23, the variable frequency oscillator 24, and the mixer 25, So that access speed may be changed based on the discriminated result by the radio propagation situation discrimination circuit 31 and the radio propagation situation discrimination circuit 31 which distinguish a radio propagation situation using the output of the memory 19 which buffered the output of the correlator 18. By the timing outputted by the access speed change-request data creation part 31 which generates the signal required of a base station, and the known signal primary detecting element 17. It comprises the control section 32 which controls the correlator 18, the memory 19, the radio propagation situation discrimination circuit 30, and the access speed change-request data creation part 31, and the receiving-field-intensity measurement primary detecting element 33 which measures receiving field intensity.

[0079]Like the 2nd example, to the data signal to which it restored by the demodulation section 16, the known signal primary detecting element 17 detects the timing of the known signal included in the data signal, and notifies to the control section 32 in the portable electronic device 10. The control section 21 to

which known signal timing was notified operates the correlator 18, the memory 19, and the radio propagation situation discrimination circuit 30. It is outputted from the correlator 18 and a correlation output is memorized by the memory 19. The radio propagation situation discrimination circuit 30 possesses the condition table for judging a radio propagation situation according to a correlation output, determines whether change the access speed of a down-link based on the condition table, and outputs that to the access speed change-request data creation part 31. With the output of the radio propagation situation discrimination circuit 30, the access speed change-request data creation part 31 creates the code required as changing the signal-transmission speed of a down-link to a base station. This requirement signal is transmitted to a base station by an uplink signal.

[0080]Although the correlator output is used as information for access speed determination in the explanation mentioned above, it is also possible to use the receiving field intensity simultaneously detected by the receiving-field-intensity primary detecting element 33. The receiving-field-intensity primary detecting element 33 outputs a detection result to the radio propagation situation discrimination circuit 30.

[0081]By the above composition, it becomes possible to change the signal-transmission speed of a down-link, and can communicate with the optimal access speed.

[0082]Next, the radio communications system concerning the 4th example of this invention is explained according to drawing 5. Drawing 5 shows the sequence of the base station and portable electronic device in the 2nd example shown in drawing 3.

[0083]The unique word for transmission line state presumption (known information) is inserted in the signal of the down-link transmitted to a portable electronic device from a base station for every fixed time of a certain. A portable electronic device performs transmission-line presumption (40) which takes correlation with the unique word. The report (41) of the transmission-line estimation result from a portable electronic device to a base station is periodically performed according to execution of transmission-line presumption. A base station determines whether the access speed of a down-link is made to change in response to the result of transmission-line presumption notified from the portable electronic device (judgment 42 with variable access speed).

[0084]As a result of the judgment (42) with variable access speed in a base

station, when the access speed of a down-link is the same as the actual condition, a base station tells only the access speed of a down-link to a portable electronic device (notice 43 of access speed). In changing access speed as a result of the judgment (42) with variable access speed, a base station tells a portable electronic device about the purport that access speed is changed and the access speed after change, and changing timing (44).

[0085]After a base station reports that access speed is changed into a portable electronic device (44), the result is disregarded when the report (41) of a transmission-line estimation result arrives at a base station from a portable electronic device, by the time it changes signal-transmission speed (45). Transmission-line presumption (40) periodically performed in a portable electronic device is not performed immediately after the signal-transmission speed variation of a down-link (46). In a base station, if the report 41 of a portable electronic device to a transmission-line estimation result is after fixed time progress, it will be validated and judgment (42) with variable access speed will be performed. Based on the result of the judgment (42) with variable access speed, if access speed is the same as the actual condition, only access speed will be told (43). In making the signal-transmission speed of a down-link change,

it tells a portable electronic device about the purport that access speed is changed at this time and the access speed after change, and changing timing (44).

[0086]Drawing 5 shows the signal-transmission speed of the down-link as an example. Before access speed change, it is 10 Msymbol/s (47) and it is shown that change signal-transmission speed to the timing which received the notice (48) which changes signal-transmission speed, and transmission is performed by 20 Msymbol/s (49) after that.

[0087]Change of the signal-transmission speed of a down-link is attained by the above sequence.

[0088]Next, the radio communications system concerning the 5th example of this invention is explained according to drawing 6. Drawing 6 shows the sequence of the base station and portable electronic device in the 3rd example shown in drawing 4. In the 4th example, although it was opting for access speed change in the base station, in the 5th example, it opts for access speed change in a portable electronic device.

[0089]The unique word for transmission-line presumption (known information) is inserted in the signal of the down-link transmitted to a portable electronic device

from a base station like the 4th example. In a portable electronic device, the time when unique word is inserted is detected and transmission-line presumption (60) is performed by taking correlation to the unique word. In a portable electronic device, it judges whether the signal-transmission speed of a down-link is changed using the result of transmission-line presumption (60) (speed variation judging 61), and in changing the signal-transmission speed set up now, it outputs a signal-transmission speed variation demand (62) to a base station. In a portable electronic device, transmission-line presumption is not performed until there is a response from a base station to a change request.

[0090]In a base station, in response to a transmission signal speed variation demand (62), it determines whether change access speed, and change and changing timing of access speed are told to a portable electronic device (64). Access speed is changed to changing timing after that (65).

[0091]a portable electronic device -- after the signal-transmission speed variation of a down-link -- transmission-line presumption -- (65) which outputs the signal-transmission speed variation demand 62 to resume 60 and the speed variation judging 61, and change access speed further, and nothing outputs when the present access speed may still be sufficient. A base station tells the

signal-transmission speed of a down-link to a portable electronic device periodically (66).

[0092]Drawing 6 shows the signal-transmission speed of the down-link as an example. Before access speed change, it is 10 Msymbol/s (67), and signal-transmission speed is changed in the timing of a notice (65) of an access speed change, and transmission is performed by 20 Msymbol/s (68) after that. Signal-transmission speed is again changed in the timing of a notice (69) of a subsequent access speed change, and transmission is performed by 10 Msymbol/s (70).

[0093]Change of the signal-transmission speed of a down-link is attained by the above sequence.

[0094]Next, the radio communications system concerning the 6th example of this invention is explained according to drawing 7. Drawing 7 is a flow chart which shows the procedure at the time of making a down-link access speed change in a base station. Drawing 7 shows processing of the judgment 42 with variable access speed in the 4th example in which transmission-line estimation data is transmitted from a portable electronic device.

[0095]If a correlation output is notified to a base station as a transmission-line

estimation result from a portable electronic device, it will start judgment with variable access speed of the flow chart shown in drawing 7. First, a base station computes the transfer characteristic between a base station and a portable electronic device using the notified correlation output (transmission-line presumption 80). A base station determines the output and the access speed r optimal from a condition table (the optimal access speed distinction 81).

[0096]Here, when the access speed r obtained by the optimal access speed judging (81) is larger than the access speed a of the down-link set up now, the next processing is performed to (82). First, it judges whether the access speed r is over the maximum of the down-link access speed which can be set up (83), and when it is not over the maximum, processing (84) which gathers access speed is performed. On the other hand, nothing is done when the access speed r is over the maximum.

[0097]It performs the following processings, in being smaller than the access speed a to which the access speed r is set now when it is not r>a as a result of comparison (82) of the access speed r and a. First, it judges whether the access speed r is less than the minimum of the access speed of the down-link which can be set up (86), and interception processing 87 is carried out to the case of less

than a minimum. On the other hand, when the access speed r is less than a minimum, processing (88) which lowers access speed is performed.

[0098]When interception processing (87) here is started, unless reception of the information from a base station is impossible for a portable electronic device and a transmission line state is recovered, in the present transmission line state, the communication to a portable electronic device from a base station becomes useless. In this invention, in order to stop communication of a down-link under the situation which cannot communicate, it becomes possible to prevent radiation of an unnecessary electric wave. In order to start communication again after interception of the communication to a portable electronic device from a base station, it redoes from the cross connection of an initial state. The transmission quality of uplink transmitted to a base station from a portable electronic device in the unsymmetrical radio communications system whose access speed of a down-link is more nearly high-speed than the access speed of uplink is high. Therefore, even if a down-link is intercepted, the communication by uplink is possible. After communication by a down-link is intercepted by the procedure by this invention, since communication by uplink is possible, cross connection for resuming can be performed easily again.

[0099]This procedure is ended when the result of said 85 is No.

[0100]Next, the radio communications system concerning the 7th example of this invention is explained according to drawing 8. Drawing 8 shows the downlink signals and the uplink signal which are transmitted between a base station and a portable electronic device.

[0101]The access speed of a down-link is wanted to be a high speed as much as possible. In order to set up the optimal access speed, transmission-line presumption between a base station and a portable electronic device is needed. However, as mentioned above, when an access method is not TDMA/TDD, transmission-line presumption cannot be carried out in a base station. It is desired for a portable electronic device to be simple as much as possible. Therefore, a base station changes the access speed of a down-link in the period To (90) decided beforehand, as shown in drawing 8. rate1 (91) to rate4 (94) differ in access speed, respectively. In a portable electronic device, after receiving all the access speed which a base station changes, the fastest access speed receivable with a portable electronic device is notified to a base station (access speed report 95). After that, communication is performed with the access speed which the portable electronic device notified (96).

[0102]The radio signal from a base station can be performed with whether it is ability ready for receiving checking the parity of received data with a portable electronic device, for example. Since judgment whether reception with the access speed notified only with the parity check can be performed is attained, the circuitry of a portable electronic device can be simplified.

[0103]The above enables it to set the signal-transmission speed of a down-link as an optimum value.

[0104]Next, the radio communications system concerning the 8th example of this invention is explained according to drawing 9. Drawing 9 shows the downlink signals and the uplink signal which are transmitted between a base station and a portable electronic device. In the 8th example, the signal-transmission speed variable method in the 7th example is performed further for a short time.

[0105]A base station changes the access speed of a down-link in the period To (90) decided beforehand. Under the present circumstances, it is set up beforehand and changes to the low speed one one by one from the more nearly high-speed one of the access speed. In a portable electronic device, the parity check of the signal transmitted by rate4 (100) from a base station is performed, and if it is ability ready for receiving, access speed will be notified to a base

station (access speed report 101). It will not be reported if it is receive-not-ready ability. In a base station, if the report of access speed is received from a portable electronic device, it will change to the access speed.

[0106]By the above method, the access speed of a down-link can be set as an optimum value. By this method, since it receives from the fastest access speed, in the transmission line state at the time of communication, the quickest access speed can be set up in short time.

[0107]Next, the radio communications system concerning the 9th example is explained.

[0108]In a communication method with unsymmetrical access speed of uplink and a down-link, few directions of the transmission quantity of uplink are desirable. Since access speed is a low speed to uplink, this is because there is little transmission capacity of a down-link within unit time. It becomes possible to reduce the transmission quantity of uplink according to the 9th example.

[0109]Drawing 10 shows the transmission signal 110 of uplink transmitted from a portable electronic device to a base station. In the transmission signal 110, the information signal (change request signal D) for changing the access speed of a down-link periodically is included. The change request signal D (111) is 2-bit

information (D1, D0), for example.

When (D1, D0) are (00), as [the present setting out] is meant (112), at the time of (01), the request of an access speed rise of a down-link is meant (113), and the request of an access speed down of a down-link is meant at the time of (10) (114).

In the state of (11), (D1, D0) show those without setting out (115).

[0110]Thus, when the variation width of the access speed set up sets up only one per access speed change request of the down-link which transmits to a base station from a portable electronic device, the transmission quantity of uplink can be reduced.

[0111]Next, the radio communications system concerning the 10th example is explained.

[0112]By the system which realizes the multimedia by high-speed radio, the signal transmitted to a portable electronic device from a base station is considered that picture information, a sound, a text, etc. are various. These information is outputted from sources of information different original respectively, and when transmitting on radio, it is multiplexed to one signal. Generally original frequency is being used for the system clock in each sources

of information by each system. In the conventional radio transmission system, the number of system clocks is one and designing so that more than one may exist is not performed. Therefore, the access speed set up with variable access speed is set as the frequency produced by carrying out dividing of the system clock. However, since the information transmitted by the system which realizes multimedia has multiplexed the information originally acquired from the sources of information of a separate system clock, if it can be responded in two or more system clocks in a portable electronic device, it can simplify multiplexing of sources of information.

[0113]Drawing 11 shows the signal-transmission speed beforehand set up in the radio communications system of the 10th example. When making access speed change, access speed can be easily changed by creating the correspondence table of access speed as beforehand shown in drawing 11 with a base station and a portable electronic device. In the example shown in drawing 11, eight steps of access speed are set up from 10Mbps (120) to 70Mbps (121). When a portable electronic device wants to set the signal-transmission speed of a down-link as 10Mbps, the control code 01 is transmitted. In a base station, access speed is set to 10Mbps according to the signal-transmission speed set

as the access speed correspondence table shown in drawing 11.

[0114]The access speed which is not an integral multiple of a system clock is contained in the access speed correspondence table. In drawing 11, it is being referred to as 53.24Mbps as an example (122). In the multi media communication system that many sources of information of the signal transmitted as explained previously exist, it is assumed that two or more different system clocks exist. In that case, in order to carry out multiplex [of the data from two or more sources of information] to a transmission signal and to make it coexist with the data from other sources of information, it is necessary to coincide the access speed of a signal. The staph synchronization etc. which insert an unnecessary bit are raised as a conventional example of this method.

[0115]In the communication method concerning this invention, since signal-transmission speed is variable, it can multiplex by making signal-transmission speed change for every data from different sources of information. That is, multiplexing becomes possible about the system clock (for example, 122) of each sources of information by entering the correspondence table of access speed, as shown in drawing 11.

[0116]Drawing 12 is the 11th example that showed the composition of the

recovery machine in the portable electronic device at the time of performing multimedia communication with two or more sources of information from which a system clock differs. It is received by the antenna 130 and the radio signal transmitted from the base station is decoded by the baseband signal by MODEM131. The control section 132 supervises the output of MODEM131, changes the switch 133 according to the kind of sources of information, and operates a decoding part corresponding from two or more decoding parts 134. Each decoding part 134 possesses PLL134 for clock synchronization, and decodes the data of each sources of information from the baseband signal inputted. It becomes possible to multiplex the signal of sources of information with which system clocks differ by changing signal-transmission speed by the above composition.

[0117]Next, the radio communications system concerning the 12th example of this invention is explained according to drawing 13. Drawing 13 shows the generation method of the signal for transmission error detection.

[0118]It can ask for the maximum access speed by presuming a transmission line state. Presumption of a transmission line state is performed using an input signal and a known signal. Generally, presumption of a transmission line needs

huge calculation. It is possible to perform a signal transmission using a control channel between a base station and a portable electronic device, and to check the transmission quality in this invention. Therefore, access speed is changed, a signal is transmitted and it becomes possible to presume a transmission line state by detecting the digital error of a demodulation signal.

[0119]In drawing 13, 2 bits of check bits 142 are first added to the data 141 of a triplet by rate1. In rate2, 5 bits containing the data division 141 and the check bit 142 of rate1 are changed into 10 bits (143) with the access speed of rate2, and the check bit 144 is added to these 10 bits (143). In rate3, 12 bits of 143 and 144 are changed into 24 bits (145) with the access speed of rate3, 24 bits (145) are received, and the check bit 146 is added. Thus, it restores to the generated digital-error detecting signal with each access speed, and it becomes possible to determine access speed by the thing of each access speed to do for a check bit inspection.

[0120]Next, the radio communications system concerning the 13th example is explained. Drawing 14 shows a part of signal of the control channel by the 12th example. As shown in the 4th example, when a base station changes the access speed of a down-link, it tells the signal-transmission speed and changing timing

(alteration time) after change. Drawing 14 shows the composition of the signal for notifying signal-transmission speed and changing timing.

[0121]First, the change code 150 which means being a notification signal at the time of changing signal-transmission speed into the signal of a down-link is sent out, and the information 151 (here, it may be 4 bits) which shows the signal-transmission speed rate after changing into the next is sent out. Next, the information 152 (here, it may be 8 bits) which shows access speed changing timing is transmitted. By the access speed changing timing 152, after what bit is transmitted from the change code 150, it is shown whether signal-transmission speed is changed.

[0122]It enables a base station to notify the signal-transmission speed and change timing of a down-link by the above method.

[0123]Next, the radio communications system concerning the 14th example of this invention is explained according to drawing 15. Drawing 15 shows the sequence of the base station and portable electronic device in the 14th example.

[0124]In order to presume the line characteristic of a down-link, the known sign 160 is inserted in the signal of the down-link transmitted to a portable electronic device from a base station. In a portable electronic device, a line characteristic is

presumed based on the known signal 160, and it determines whether change the signal-transmission speed of a down-link. Simultaneously with transmission-line presumption, with the portable electronic device, it restored to the received wave sent from a base station, and information has been acquired. In changing the signal-transmission speed of a down-link, it outputs the access speed change request 161 to a base station. In the example shown in drawing 15, the signal-transmission speed to receive is changed at the same time it outputs the access speed change request 161. Therefore, it cannot restore to a received wave until it is transmitted from a base station with the same access speed as the signal-transmission speed which a portable electronic device is receiving. In a base station, the signal-transmission speed of a down-link is changed according to the access speed change request 161 (162). In a portable electronic device, downlink signals after signal-transmission speed was changed are received, and the recovery of a signal which received is resumed (163).

[0125]The above sequence enables it to change the signal-transmission speed of a down-link. In the 4th example, it changes from a base station by transmitting the timing which changes the signal-transmission speed of a down-link to a portable electronic device. In the 14th example, since a change is immediately

performed to the signal-transmission speed variation demand from a portable electronic device, it becomes possible to follow a quick transmission line change.

[0126]When a portable electronic device changes the access speed of a received wave simultaneously with the change request of signal-transmission speed like the 14th example, When a change request is not transmitted to a base station by the digital error, since the signal-transmission speed at the time of reception with a portable electronic device differs from the signal-transmission speed at the time of transmission of a base station, communication by a down-link becomes impossible. The following methods are effective in order to avoid this.

[0127]First, if the 1st supervises the signal from a fixed time base station and is unreceivable after a portable electronic device's transmitting the change request of signal-transmission speed, it is the method of returning to the original access speed. The 2nd is the method of providing two or more demodulation sections so that a portable electronic device can receive two or more different signal-transmission speed.

[0128]In the 1st method, since a portable electronic device returns again after the fixed time which outputted the signal-transmission speed variation demand

at the signal-transmission speed in front of a change request, there is a fault in which the transmission quality is not improved. For the solution, the method of telling signal-transmission speed by a control channel is taken. That is, the aforementioned problem is solved by telling a portable electronic device about the access speed of the signal transmitted from a base station. two or more demodulation sections are provided in the 2nd method -- by the ability to kick, since there is nothing if it is ****, realization of a miniaturization of a portable electronic device is made difficult. However, it becomes possible by taking the above composition to improve the transmission quality.

[0129]As explained in full detail above, in a communication method with unsymmetrical access speed of uplink and access speed of a down-link, the access speed of a down-link can be changed according to the propagation situation between a base station and a portable electronic device. This enables it to secure the transmission quality of a down-link.

[0130]If only the circuit which presumes a transmission line state in a portable electronic device is provided, it will become possible to grasp a propagation situation in a base station, and it will become possible to realize variable access speed also with access methods other than TDMA/TDD. If the circuit which

performs judgment to which access speed is changed in a portable electronic device is provided, unnecessarily, more, notifying the propagation situation of a down-link to a base station can reduce the transmission quantity of uplink, and it can improve a synthetic throughput.

[0131]According to this invention which was decided beforehand and which changes the access speed of a down-link for every period, and asks for the optimal access speed, it becomes possible to simplify the circuit which presumes a transmission line state. It becomes possible to shorten the time required in order to ask for the optimal access speed.

[0132]The access speed of uplink becomes possible [solving the problem of transmission capacity reduction of uplinks generated according to a low thing] compared with the access speed of a down-link. It becomes possible to decrease useless wireless transfer unreceivable with a portable electronic device.

[0133]In the multimedia service which transmits the signal of two or more sources of information with which system clocks differ, it becomes possible to multiplex the information from which a system clock differs. It becomes possible to make easy a change of the access speed in a portable electronic device by

notifying the access speed after the timing which changes the access speed of a down-link, and change.

[0134]Next, in order to secure the high transmission quality and to improve the reliability of information and telecommunications, the radio communications system which performs communication which used the error correcting code is explained. Below, securing the high transmission quality using an error correcting code, power consumption is reduced, and composition of a simple portable electronic device is enabled, and improvement in the whole transmission efficiency is aimed at.

[0135]The radio communications system concerning the 15th example of this invention is explained. In the radio communications system which comprises a base station and a portable electronic device, drawing 16 is a block diagram showing the composition of the error correction system formed in the portable electronic device.

[0136]The error correction system in a portable electronic device, The radio signal transmitted to the portable electronic device from the base station (not shown). From a radio signal to the receiving antenna 201 and a data signal to receive. The receiving set 202 changed into a (symbol string), the

transmission-quality estimating device 203 which presumes the transmission quality of the transmission line between a base station and a portable electronic device, the switch controller 204 which performs switching control of the switches 205a and 205b according to the estimation result by the transmission-quality estimating device 203, The switches 205a and 205b which change the course of the data signal outputted from the receiving set 202 to any of the redundancy stripper 206 or the error correction decoding device 207 they are, It comprises the redundancy stripper 206 which removes the redundant portion (error correcting code) for the error correction in a data signal, the error correction decoding device 207 which performs error correction decoding to a data signal, and the processing unit 208 which performs various processing about a data signal.

[0137]The signal transmitted from a base station is made from the 15th example from the symbol string error-correcting-code-ized using the numerals which can acquire an information series only by removing redundancy. An error can be started in the radio transmission line from a base station to a portable electronic device. The transmission-quality estimating device 203 presumes the transmission quality of a transmission line, and controls whether a symbol string

is processed by the switch controller 204 with an error correction system, or it is processed by the redundancy stripper. Usually, in order to secure the high transmission quality, as shown in drawing 16, the switches 205a and 205b are changed to the error correction decoding device 207 side, and a data signal is processed by the error correction system.

[0138]In drawing 16, it is drawn as if the receiving set 202 received the electric wave, but they may be transmission media other than an electric wave.

[0139]Drawing 17 shows the composition of the transmission-quality estimating device 203 in the 15th example of an invention. Generally, while exact measurement of the transmission quality is difficult, cost starts. For this reason, the transmission-quality estimating device 203 for facilitation of transmission-quality presumption, Distribution of the measurement result of the high physical development of the transmission quality and correlation, i.e., (1) receiving field intensity, and (2) eye patterns, detection of (3) known patterns (unique word (known information)), the error rate after (4) reception, and (5) and others independently, Or by combining, the transmission quality is presumed and switch-off substitute control is directed to the switch controller 204.

[0140](1), for example from the receiving set 202, input measurement of

receiving field intensity and the transmission quality by (2) eye patterns about the data about each, and perform it. As measurement of the transmission quality by (3) known patterns (unique word (known information)) is shown, for example in the 4th example and the 5th example, it is performed. Namely, the known pattern for transmission-quality presumption of a transmission line is inserted in the downlink signals transmitted from the base station, and it carries out by detecting this known pattern. To drawing 16, the known signal primary detecting element for detecting a known pattern is not illustrated. (4) The error detection after performing the redundancy removal by the redundancy stripper 206 or the error correction by the error correction decoding device 207, for example performs measurement of the transmission quality by an after-reception error rate.

[0141]Here, the transmission-quality measuring device 203 shall direct control of a switch-off substitute based on the bit error rate acquired by (3) known patterns and the error rate after (4) reception. In this case, the judgment based on a bit error rate will be performed in two steps error correction before and after an error correction. The transmission-quality measuring device 203 compares with a bit error rate the threshold (reference quality) set up beforehand, and, as a result,

when a bit error rate is larger than a threshold, It directs to change the switches 205a and 205b to the error correction decoding device 207 side to the switch controller 204. When the bit error rate of the transmission-quality measuring device 203 is below a threshold as a result of comparison, it directs to change the switches 205a and 205b to the redundancy stripper 206 side to the switch controller 204. Under the present circumstances, the threshold to a bit error rate is set as two steps in consideration of coding gain. That is, in the judgment after an error correction, naturally, since the bit error rate is low, a threshold is also set up according to it.

[0142]For example, if the power consumption which operation of the redundancy stripper 206 takes considers it as a sufficiently small thing as compared with the power consumption which operation of the error correction decoding device 207 takes, If the frequency exceeding a threshold is a half as a result of comparison with the bit and error rate in the transmission-quality measuring device 203, and a threshold, the power consumption which decoding takes will be reduced in a half. Therefore, since the power consumption of an electronic portable instrument is reduced, it becomes possible to simplify composition.

[0143]The algorithm for opting for operation of an error correction system based

on the point estimate of transmission line quality in the 15th example is shown in drawing 18 thru/or drawing 20. The point estimate (xt) of the transmission quality in the time t called for by the transmission-quality estimating device 203 as shown in drawing 18, As a result of comparing a threshold (reference quality), when xt is below a threshold, since it is redundant, performing an error correction suspends an error correction, and it aims at reduction of power consumption. When xt exceeds a threshold, an error correction is operated in order to secure the high transmission quality. He is trying for adding an inertial term to the algorithm shown in drawing 18 further, and also referring to the past n times of point estimates to raise the accuracy of the point estimate of the transmission quality in the algorithm shown in drawing 19. The algorithm shown in drawing 20 enables it to reduce the storage capacity of the past point estimate by making an inertial term become a relation of an exponent.

[0144]Drawing 21 and drawing 22 show the example of composition of the concatenated code in the case of using a concatenated code, in order to measure an after-reception error rate in the 15th example.

[0145]In the composition shown in drawing 21, the redundancy which consists of error detecting code CRC (211) and error correcting code ECC (212) is added to

the information bit 210. The information bit 210 is error-correcting-code-ized after being coded by error detecting code CRC (211). The error detection after performing an error correction or redundancy removal performs presumption of an after-reception error rate. However, it does not perceive about the error contained in a redundant portion in this case. It becomes possible to heighten error correction capability when the error correction system is operating by using the numerals which can perform error detection and an error correction simultaneously instead of [other than composition of being shown in drawing 21] an error detecting code, for example, a BCH code etc. As numerals which can take out an information series from a symbolic language easily even if it does not perform an error correction, there are systematic numerals and Invertible numerals, QLI numerals, etc.

[0146]In the composition shown in drawing 22, the redundancy which consists of error correcting code ECC (214) and error detecting code CRC (215) is added to the information bit 213. After the error correction of the information bit 213 is carried out by error correcting code ECC (214), it is coded by error detecting code CRC (215). Presumption of an after-reception error rate performs error detection by error detecting code CRC (215) first. Then, redundancy removal or

an error correction can be performed. It becomes possible to heighten error correction capability when the error correction system is operating by using, the numerals which can perform error detection and an error correction simultaneously instead of, for example, a BCH code etc., etc. [error detecting code CRC]

[0147]Drawing 23 shows another example of composition of the error correction system in the 15th example. In drawing 23, the numerals which use syndrome as error correction decoding are used. When the numerals using syndrome are used, decoding is performed in two steps, the syndrome computing device 221 and the error pattern generating device 225, and it can be detected whether the error is contained in the symbolic language by syndrome. An after-reception error rate can be used for presumption of the transmission quality by using syndrome calculation as an error detection mechanism. According to this composition, since it does not independently have an error detection mechanism, it becomes reduction of circuit structure.

[0148]Next, it explains, referring to drawing 24 for the 16th example of this invention. Drawing 24 is a block diagram showing the composition of the error correction system in the 16th example. Identical codes are attached about the

error correction system and identical parts of the 16th example which are shown in drawing 16, and explanation is omitted.

[0149]There is a means to control error correction capability besides the control using the transmission-quality information by the transmission-quality estimating device 203. For example, since the electronic personal digital assistant is used, the remainder of the electric power of a terminal has decreased and an error may be permitted, consumption of electric power is reducible because it is made not to perform error correction decoding by control from the outside in the situation of liking to get information to the last compulsorily. According to the importance of the information which is communicating, the tolerance of an error is also controllable according to the directions from a user. It is also possible to perform control by an OSI hierarchy's high order hierarchy.

[0150]Next, it explains, referring to drawing 25 for the 17th example of this invention. Drawing 25 is a block diagram showing the composition of the error correction system in the 17th example. Identical codes are attached about the error correction system and identical parts of the 16th example which are shown in drawing 16, and explanation is omitted.

[0151]The reliability of information can be guaranteed, such as performing error

detection and performing resending control according to the result with the error detection equipment 228, before redundancy removal, even when the error correction decoding device 207 does not perform an error correction. An error signal is transmitted to a high order hierarchy (drawing 25 processing unit 208). The processing unit 208 controls an electronic portable instrument to perform request sending of information to a base station.

[0152]For example, such a mechanism can be realized by using the numerals which can perform both an error correction and error detection, for example, a BCH code, without dropping a transmission rate.

[0153]Next, it explains, referring to drawing 26 for the 18th example of this invention. Drawing 26 is a block diagram showing the composition of the error correction system in the 18th example. Identical codes are attached about the error correction system and identical parts of the 16th example which are shown in drawing 16, and explanation is omitted. The error correction system 233-1 which has several capability to have differed, respectively in the error correction system shown in drawing 26 - 233-n are provided.

[0154]When multimedia service is realized by the down-link from a base station, various existence of some gestalten, for example, a sound, the picture, etc. is

recognized at the information transmitted from a base station to an electronic portable instrument. In an electronic portable instrument, the switch controller 230 functions so that a most suitable error correction system may be chosen from two or more error correction systems 233-1 - 233-n according to the gestalt of the transmitted information. Although it is necessary to get to know which gestalt the information on is sent in the electronic portable instrument side, this can be directed using the information added to the information which is told beforehand or is transmitted in forms, such as a header. The switch controller 230 changes the switches 231a and 231b so that the gestalt of the information transmitted may be distinguished and an error correction may be performed by a corresponding error correction decoding device. . This changes the degree of an error correction with a sound according to the importance over listening comprehension, for example according to human being's aural characteristic. Or in transmission of a picture, since information important for the dc component after performing orthogonal transformation is included, error correcting code-ization with high capability can be performed, and the alternating current component can choose the error correcting system of the form where it was suitable according to the gestalt of information, such as raising a rate with

performing an error correction with low capability.

[0155]Next, it explains, referring to drawing 27 for the 19th example of this invention. Drawing 27 is a block diagram showing the composition of the radio communications system using the error correction system in the 19th example.

[0156]A receiving station (electronic gestalt device) controls operation for an error correction system by presuming the quality of a transmission line with the transmission-quality estimating device 243, controlling execution of the error correction by the error correction decoding device 246 according to an estimation result, and performing a negotiation between transmitting stations (base station).

[0157]It supposes that an error correction is not performed when judged with the transmission quality being inferior to reference quality, and an error correction is performed when judged with fulfilling reference quality.

[0158]Drawing 28 shows the example of the negotiation of the transmitting station and receiving station in the radio communications system of the 19th example. The receiving station which detected degradation of the transmission quality opts for use of the error decoding correction device 246, and transmits the notice of transmission-quality degradation for urging use of the error

correction decoding device 246 to a transmitting station. A transmitting station notifies a receiving station that the notice of transmission-quality degradation was received, the error correcting code-ized device 256 was operated, and the error correcting code-ized device 256 was operated. Since it turns out that the signal to receive is error-correcting-code-ized, the receiving station which received the notice changes the switches 245a and 245b with the transmission-quality estimating device 243, and it is operation **** about the error correction decoding device 246.

[0159]It can be judged that the information received in the period after detecting degradation of transmission line quality until the error correction decoding device 246 operates lacks in reliability remarkably. Therefore, reliability can be improved by throwing away the information on this period.

[0160]The receiving station which detected that transmission line quality had been improved notifies the non-use of the error correction decoding device 246 to a transmitting station. The transmitting station which received the notice suspends operation of the error correcting code-ized device 256, and notifies the receiving station side that it stopped. The receiving station which received the notice stops operation of the error correction decoding device 246.

[0161]Improvement in the transmission rate by drawing 29 not performing the coding in the communications system which used the error correction system of the 19th example is shown. While the error correction system is not operating, by not transmitting the redundant portion by error-correcting-code-izing, code length is shortened and a transmission rate is raised.

[0162]Drawing 30 shows improvement in a transmission rate when information is embedded at the redundancy part by error-correcting-code-izing in the communications system which used the error correction system of the 20th example. A transmission rate is raised with replacing with the redundant portion by error-correcting-code-izing, and embedding an information bit while the error correction system is not operating.

[0163]Drawing 31 is a block diagram showing the composition of the communications system using the error correction system in the 21st example. Two or more error correction decoding devices 255-1 which responded to the difference in the transmission quality - 255-n are provided in the error correction system in the 21st example.

[0164]For example, there are the numerals A for high error rates and the numerals B for low error rates, and the error correction decoding device

corresponding to each is formed. Usually, the numerals B are used, when it is expected that an error becomes high, it switches to the numerals A, and when an error rate is expected that an error hardly arises low, it will transmit, after coding with the numerals B, and an error correction will not be performed, or the coding itself will be stopped.

[0165]Suitable numerals differ in a transmission line with many errors of burst nature, and a transmission line with many errors of random nature. In this case, the kind of error also needs to recognize a transmission-quality estimating device.

[0166]In a portable electronic device, it is used according to the change of numerals, choosing an error correction decoding device corresponding from two or more error correction decoding devices 255-1 - 255-n. Optimal control of power consumption is performed maintaining fixed reliability by choosing an error correction decoding device by the estimation result of the transmission quality by the transmission-quality estimating device 203. A redundancy stripper may also be included in a decoding device. An error correction system suitable for the reliability demanded can also be chosen.

[0167]Drawing 32 shows the block diagram showing the composition of the

communications system using the error correction system in the 22nd example. The error correction system of the 22nd example communicates with the base station 260, and raises the accuracy of presumption of the transmission quality by cooperating. For example, I send the measurement result of the high physical development of the transmission qualities, such as receiving field intensity, and correlation, have complicated calculation which is possible only for the base station 260 performed to the base station 260, and have the result returned, and the switches 205a and 205b are controlled by the switch controller 227. Since the base station 260 can acquire more extensive information, it can raise the accuracy of presumption about the transmission quality. The base station 260 can use the result of the past about the relation between a place, time, etc. and the transmission quality using database 261 grade. For example, when using the same transmission line by transmission and reception like TDD by radio, the transmission-quality estimating device 271 can be simplified by having measurement of a part of quality measurement (influence of shadowing to a transmission line, etc.) of a transmission line contracted.

[0168]The portable electronic device of easy composition of that power consumption can be saved can be provided guaranteeing the reliability of

information by controlling error correction capability accommodative, if the error correction system of this invention is used, as explained in full detail above.

[0169]It not only uses an error correction system independently, but it becomes possible by incorporating as some radio communications systems to heighten an effect in respect of power consumption and communication efficiency further.

[0170]

[Effect of the Invention]As explained in full detail above, according to this invention, the error generated in the signal transmitted to a portable electronic device from a base station is decreased, The whole transmission efficiency is raised securing the high transmission quality in a down-link irrespective of the existence of a multipass, and it becomes possible to simplify composition of a portable electronic device further.

[0171]It becomes possible to reduce power consumption, and to enable composition of a simple portable electronic device, and to raise the whole transmission efficiency, securing the high transmission quality using an error correcting code.

TECHNICAL FIELD

[Industrial Application]A portable electronic device this invention rather than the uplink transmission speed which transmits a signal to a base station. Uplink transmission speed and down-link access speed with the more nearly high-speed down-link access speed with which said base station transmits a signal to said portable electronic device are applied to an unsymmetrical radio communications system, and make the down-link more nearly high-speed than uplink, It is related with the radio communications system which transmitted a lot of information to the portable electronic device from the base station by the information transmission demand of a small quantity of a portable electronic device.

PRIOR ART

[Description of the Prior Art]In radio, "the transmission characteristic analysis of a symbol rate and an abnormal-conditions multi valued number variable adaptive modulation method" of Shingaku Giho RCS94-64 (1994-09) and

pp.31-36 is mentioned as a conventional example of the transmission system characterized by variable access speed. In the above-mentioned literature, the method which changes an abnormal-conditions multi valued number and a symbol rate to the basis of the constraint of keeping the transmission quality constant, according to a transmission line state is indicated. Since the multiplex mode is made into TDMA/TDD, the radio signal outputted to the portable electronic device and the radio signal outputted to the base station from the portable electronic device receive the same transmission line change from a base station. In the transmission line state estimating part of a base station, instant C/N is calculated using this reversibility, and transmission-line presumption is performed. Since a multiplex mode is TDMA/TDD in this method, in a base station, transmission-line presumption is possible. Conversely, a system applicable since the multiplex mode will be limited if it says will be restricted.

[0003]The kind of access speed in the above-mentioned literature which can be selected is shown in drawing 33. Change of a multi valued number is QPSK, 16QAM, 64QAM, and 256QAM. Change of a symbol rate is 8 ksymbol/s, 16 ksymbol/s, 32 ksymbol/s, and 64 ksymbol/s. thus, the signal-transmission speed

of the system which transmits by radio conventionally -- at most -- they are tens ksymbol/s.

The frequency band to occupy is also about tens of kHz.

[0004]Transmission-line distortion is generated by a multipass or phasing. A multipass happens in order to add the ingredient in which the propagation path between a base station and a portable electronic device carried out multiplex transmission not only with the ingredient which reaches directly but with the building. The delayed wave component by multiplex transmission is independently generated in a fixed value to change of signal-transmission speed. Therefore, the influence of the transmission-line distortion by a multipass becomes severe as signal-transmission speed becomes high-speed. When trying to perform high-speed transmission under multipath environment, it is necessary to use a usually very complicated and large-scale adaptive equalization circuit.

[0005]By the way, there is a method using the error correcting code as a method which secures the high transmission quality and improves the reliability of information and telecommunications. In the communication using an error

correcting code, the signal coded by coding equipment by the transmitting information side is decoded with the decoding device of a receiver. There is satellite communication as an example of the communication using an error correcting code. In health communication, in order to stop the electric power which the satellite itself consumes, error correction technique is used. The various error correcting codes for using for various application are developed.

[0006]It is necessary to press down power consumption at the transmitting side (satellite) like satellite communication. In the receiver (base station) which is on the ground, as a matter of fact, when [that there was a power difference clearly] there were no restrictions about electric power, coding equipment had become easy composition so that power consumption might decrease, and though power consumption of a decoding device increased, even when it was complicated, it was satisfactory.

[0007]In usual, the information and telecommunications which used the error correcting code require time and effort for decoding processing. When it thinks theoretically, decoding processing is operation of correcting the received code, there being a huge table which put in order all the possible received codes and the information code corresponding to this, and referring to this table. It has

come to be able to do decoding processing efficiently (rather than pulling a table) actually using structure with a table. In order to heighten error correction capability, it is necessary to lengthen code length but, if code length is lengthened, complication of a processing unit and increase of power consumption will be imitated, and it is **. When performing high speed processing, pipeline processing must be performed using two or more error correction systems, but it means that this prepares many error correction systems of the same structure, and power consumption becomes large further.

[0008]In the communications system using the conventional error correction system, irrespective of the quality of a transmission line, an error correction decoding device is always operated and the information and telecommunications using an error correcting code are performed. That is, it means operating, though transmission line quality is good and an error correction is unnecessary, and the device which consumes much electric power is made to operate vainly. By the way, the demand of the mobile communications which use the portable electronic device "anyone can communicate always anywhere" in recent years is increasing. Furthermore, multimedia ["which can be communicated anything"] formal ** is also capturing

the spotlight. That is, in the former, when a portable electronic device was used, it was mainly audio communication, but in recent years, the information and telecommunications of various gestalten, such as text, picture information, and moving image information, come to be performed besides a sound, and the demand to communicative reliability is increasing. furthermore -- "-- always -- anywhere -- anyone -- " -- "anything" -- the united multimedia type mobile communications can also be considered and it is possible that the demand to communicative reliability increases further.

[0009]A situation contrary to the satellite communication mentioned above produces the problem of the reliability in the portable electronic device of multimedia type mobile communications. That is, in that communication which used the error correcting code is performed, in order to improve communicative reliability, although it is the same, the relation of the power which can be consumed is reversed. A portable electronic device has restrictions in the electric power which can be consumed for a small weight saving, and cannot consume power great for an error correction. In this case, a transmitting station is a base station and there are few restrictions about power consumption compared with a portable electronic device.

[0010]That is, the demand to communicative reliability is increasing further in the situation where the restriction about electric power is severer.

EFFECT OF THE INVENTION

[Effect of the Invention]As explained in full detail above, according to this invention, the error generated in the signal transmitted to a portable electronic device from a base station is decreased, The whole transmission efficiency is raised securing the high transmission quality in a down-link irrespective of the existence of a multipass, and it becomes possible to simplify composition of a portable electronic device further.

[0171]It becomes possible to reduce power consumption, and to enable composition of a simple portable electronic device, and to raise the whole transmission efficiency, securing the high transmission quality using an error correcting code.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Thus, in the conventional radio, when the down-link from a base transceiver station to a portable electronic device was constituted from fixed access speed, for example, it tried to have performed high-speed transmission of about 150 Mbps, there was a problem that it could not communicate at all, at the place where a multipass exists. When the circuit design was performed in consideration of the multipass, only the low-speed link could be realized, but only low-speed transmission was able to be performed also at the place where a multipass does not exist. When trying to perform high-speed transmission under multipath environment, a very complicated and large-scale adaptive equalization circuit will be used, and it had become the miniaturization of a terminal (portable electronic device), and an obstacle of low power consumption.

[0012]In the portable electronic device of the multimedia type mobile communications which perform information and telecommunications using an error correcting code, although the restrictions about power consumption were large, there was a problem that the demand to reliability was high. Therefore, after securing high reliability, the radio communications system which can reduce the power consumption of a portable electronic device was demanded.

[0013]The place which this invention was made in consideration of the above situations, and is made into the purpose, The error generated in the signal transmitted to a portable electronic device from a base station is decreased, It is providing the radio communications system which the whole transmission efficiency's is raised securing the high transmission quality in a down-link irrespective of the existence of a multipass, and can simplify composition of a portable electronic device further.

[0014]The purpose of this invention is to provide the radio communications system which power consumption is reduced, and composition of a simple portable electronic device is enabled, and can raise the whole transmission efficiency, securing the high transmission quality using an error correcting code.

MEANS

[Means for Solving the Problem]In order to solve the above-mentioned problem, in a radio communications system in this invention, it is characterized by making access speed of a down-link variable independently in a radio communications system with unsymmetrical access speed of a down-link and access speed of

uplink.

[0016]In a radio communications system of variable access speed currently performed conventionally. Since a multiplex mode is TDMA/TDD, it is assumed even from which direction of communication to a portable electronic device from a base station, and communication to a base station from a portable electronic device that a radio propagation characteristic between portable electronic devices shows the almost equivalent characteristic from a base station. However, when a system which will be the requisite is a radio communications system with unsymmetrical access speed, a radio propagation characteristic between a base station and a portable electronic device cannot carry out transmission-line presumption in a base station rather than is [therefore] reversible. Thus, in a method as which a base station of a conventional example determines access speed, variable access speed is unrealizable.

[0017]So, in this invention, a portable electronic device has a means to presume a radio propagation situation with a base station, a radio propagation situation acquired by the estimation means is transmitted to a base station with a radio signal, and it is characterized by changing access speed of a down-link in a base station.

[0018]A means by which a portable electronic device presumes a radio propagation situation with a base station, It has a means to determine access speed of a down-link from a radio propagation situation acquired by said means, and a portable electronic device is characterized by transmitting a demand to which access speed of a down-link is changed with a radio signal to a base station.

[0019]In order to use a radio-wave-propagation situation from a base station to a portable electronic device as an index at the time of changing access speed of a down-link, it is necessary to provide a circuit which determines the maximum access speed from a result obtained by performing transmission-line presumption to a portable electronic device. However, it is needed that composition of a portable electronic device is simple as mentioned above.

[0020]In order to fill this conflicting requirement, in this invention, a base station is characterized by a thing which were decided on beforehand and for which access speed of a down-link is changed for every period, the maximum access speed that can receive a portable electronic device is notified with a radio signal to said base station, and access speed of said down-link is opted.

[0021]A changing method which was decided beforehand and to which access

speed of a down-link is changed for every period is characterized by making it change from high-speed access speed to access speed [low speed one by one].

[0022]There are few amounts of signal transmissions from a portable electronic device to a base station than the amount of signal transmissions which can be transmitted to a portable electronic device from a base station in a radio communications system with unsymmetrical access speed. Therefore, as much as possible little transmission quantity of uplink is wanted for there to be.

[0023]Then, in a radio communications system with which access speed of a down-link is beforehand determined discretely between said base station and said portable electronic device in this invention, A means by which said portable electronic device detects an error from said base station to a signal transmitted on radio to said portable electronic device, A means to determine access speed of said down-link according to a transmission error situation acquired from said means is provided, and said portable electronic device is characterized by performing a demand which gathers one step of access speed, or lowers it one step to said base station.

[0024]As for useless communication whose reception becomes impossible from a viewpoint of effective use of a channel in a portable electronic device, not

existing is desirable. When a line characteristic is changed by shadowing etc. and the transmission quality deteriorates, a base station and a portable electronic device set up carry out signal-transmission speed of a down-link to communication quality being improved late. Even if it communicates with the minimum access speed, when communication quality cannot be secured, operation which makes access speed slow will become useless.

[0025]Then, in a radio communications system with which access speed of said down-link is beforehand determined between said base station and said portable electronic device in this invention, When said signal-transmission speed decided beforehand is [access speed of a down-link] a low-speed thing most and a demand is advanced so that said portable electronic device may make access speed of a down-link a low speed further, communication to said portable electronic device from said base station is intercepted.

[0026]Since access speed of a down-link is a high speed in a communication main-actor-in-a-No-play sum with unsymmetrical access speed, transmission capacity to a portable electronic device is large compared with uplink from a base station. Therefore, it is possible to insert a known signal for transmission-line presumption frequently.

[0027]So, in this invention, said base station device is characterized by inserting a known signal for transmission-line presumption in communication to said portable electronic device from said base station periodically.

[0028]By a communication method of the conventional variable access speed, it is assumed as an access method that TDMA/TDD mentioned above. Therefore, when changing access speed of a signal according to a transmission line state, access speed of uplink and access speed of a down-link are changed simultaneously. Since transmission-line presumption was possible in a base station, it was possible to have changed access speed only by a base station notifying change of access speed. However, when transmission-line presumption is impossible in a base station, access speed cannot be determined in a base station independent.

[0029]In this invention, on a basis a radio propagation situation acquired by said estimation means Then, said base station. Or said base station and said portable electronic device are characterized by determining timing to which signal-transmission speed is changed using a control channel by which said portable electronic device made a decision to which access speed of said down-link is changed, and was prepared for said down-link and said uplink.

[0030]It comprises a portable electronic device provided with radio equipment, and a base station which a radio signal from said portable electronic device is received, and transmits information to said portable electronic device with a radio signal, In a radio communications system whose down-link access speed to which said base station transmits a signal to said portable electronic device is more nearly high-speed than rise ring access speed to which said portable electronic device transmits a signal to said base station, A receiving set from which a signal showing a symbol string error-correcting-code-ized using numerals which can acquire an information series only by said portable electronic device removing redundancy is transmitted by a radio signal, and changes this signal transmitted into a symbol string, An error correction decoding device which decodes said symbol string obtained by said receiving set, and performs an error correction, A redundancy **** device which removes and decodes only redundancy without carrying out the error correction of said symbol string obtained by said receiving set, When judged with the transmission quality presumed by transmission-quality estimating device which presumes the transmission quality of a transmission line where a radio signal which said receiving set received was transmitted, and said transmission-quality estimating

device being inferior to reference quality, said symbol string is processed with said error correction decoding device, An error correction system which comprised a switching means changed so that it may process by said redundancy stripper, when judging that said transmission quality fulfills reference quality was provided.

[0031]The error correction system can control selection of processing of said symbol string, i.e., selection of said error correction system and said redundancy stripper, from an external device besides presumption of the transmission quality by a transmission-quality estimating device.

[0032]Even when it has error detection equipment which can detect that an error is contained in said symbol string and a transmission-quality estimating device has chosen a redundancy stripper, it is an error correction system detecting an error with said error detection equipment.

[0033]some gestalten are among information transmitted and said information is most suitable according to a gestalt of information out of two or more error correcting codes -- it being error-correcting-code-ized and, It is an error correction system having two or more decoding devices corresponding to said error correcting code, and choosing a decoding device from said decoding

devices according to a gestalt of said information.

[0034]It comprises a portable electronic device provided with radio equipment, and a base station which a radio signal from said portable electronic device is received, and transmits information to said portable electronic device with a radio signal, In a radio communications system whose down-link access speed to which said base station transmits a signal to said portable electronic device is more nearly high-speed than rise ring access speed to which said portable electronic device transmits a signal to said base station, Have said base station and an error correcting code-ized device which error-correcting-code-izes a radio signal transmitted to said portable electronic device said portable electronic device, An error correction decoding device which carries out error correction decoding of the error-correcting-code-ized radio signal, It has a transmission-line-quality estimating device which presumes transmission line quality of a transmission line where a radio signal was transmitted, When judged with the transmission quality being inferior to reference quality with said transmission-quality estimating device of said portable electronic device, An error-correcting-code-ized radio signal by said error correcting code-ized device is transmitted, and it decrypts with said error correction decoding device, and

when it judges that the transmission quality fulfills reference quality, error correcting code-ization is not performed but said error correction decoding device is suspended.

[0035]A radio communications system using an error correction, A transmission rate is raised with embedding information without suspending an error correction system, and notifying non-use of an error correction system to a transmitting station which performs error correcting code-ization and performing error correcting code-ization by the transmitting station side, when judging that said transmission quality fulfills reference quality.

[0036]A transmitting station has two or more error correcting code-ized devices which process a different error correcting code, A receiving station has two or more error correcting code-ized devices which a transmitting station has, and two or more corresponding error correction decoding devices, A receiving station presumes the transmission quality with said transmission-quality estimating device, and according to the transmission quality, An error correction decoding device which was most suitable with said two or more error correction decoding devices is chosen, Report to a transmitting station which error correction decoding device is used, and it determines to use an error correcting code

corresponding to an error correction decoding device which the receiving station side uses in the transmitting station side, In the receiving station side which notified the receiving station side that an error correcting code-ized device to be used was changed and an error correcting code-ized device was changed, and received a notice, it is a radio communications system changing an error correction decoding device.

[0037]It is a communications system using an error correction system, wherein a receiving station notifies presumption of the transmission quality by said transmission-quality estimating device to a transmitting station and the transmitting station side chooses an error correcting code to be used.

OPERATION

[Function]By this invention, in a radio transmission system with unsymmetrical access speed, it becomes possible to set it as the fastest signal-transmission speed under the radio propagation situation from a base station to a portable electronic device, and it can improve synthetic transmission capacity

(throughput).

[0039]The principle of this invention is explained based on the example in which multipass distortion changed in the transmission line from a base station to a portable electronic device exists. In order to make the access speed of a down-link high-speed in this radio communications system, under multipath environment, many errors occur in a transmission signal. In a portable electronic device, based on the signal transmitted by radio from a base station, the radio propagation situation from a base station to a portable electronic device is presumed, and the fastest access speed that can be transmitted is determined in a portable electronic device or a base station from the presumed result. It is required that a portable electronic device should lower signal-transmission speed when the propagation situation between a base station and a portable electronic device is bad. If access speed is lowered, the amount of signal transmissions which can be transmitted in unit time will be reduced, but the error of a transmission signal decreases.

[0040]When a radio propagation situation is bad, ARQ is performed in order to compensate a digital error. That is, ARQ is frequently performed by many digital errors. A throughput decreases from this. In this invention, signal-transmission

speed is reduced and it becomes possible by improving a noise characteristic-proof to reduce generating of a digital error. As mentioned above, the amount of information transmissions itself decreases by reducing signal-transmission speed, but synthetic transmission capacity improves by reduction of ARQ generating by a digital error decreasing.

[0041]Conversely, when there is little influence by multipass distortion, sufficient performance is not obtained with fixed access speed. In spite of being able to transmit this with higher access speed, it is for transmitting at a low speed immobilization signal-transmission speed. When it is judged that it is possible to observe a radio propagation situation in a portable electronic device, and also to raise signal-transmission speed in this invention, it is required that signal-transmission speed should be gathered to a base station. In response to this requirement signal, processing which gathers the signal-transmission speed of a down-link is performed in a base station. By the above method, it becomes possible to transmit the maximum rate according to the transmission line state, and total access speed can be gathered.

[0042]In order to change the access speed of a down-link by communication about change of the access speed of a portable electronic device and a base

station, also in access methods other than TDMA/TDD which cannot perform transmission-line presumption by a base station side, variable access speed can be realized and a synthetic throughput improves.

[0043]Since the access speed of the down-link for which it opted beforehand is changed in time, the optimal signal-transmission speed can be easily found with a portable electronic device, and, thereby, portable electronic device ********** can be simplified.

[0044]It becomes possible [the access speed of uplink] by determining changing signal-transmission speed between a base station and a portable electronic device, and change timing by a control channel to change only the access speed of a down-link.

[0045]In order to secure the high transmission quality and to improve the reliability of information and telecommunications, there are the following operations in the radio communications system which performs communication which used the error correcting code.

[0046]In a situation with the sufficient transmission quality, since an error correction is not required, it is not operating the error correction system highly attached in respect of power consumption, and power consumption is not

necessarily reduced.

[0047]It enables it to control selection of an error correction decoding device and a redundancy stripper also from other than a transmission-quality estimating device. For example, since the remainder of the electric power which is accumulating the terminal has decreased and some errors may be permitted, a user can choose not operating an error correction system compulsorily for information to come to hand to the last.

[0048]Since it becomes possible by detecting existence of an error with error detection equipment to correct an error by resending or other means even when the error correction system is not making it operate for reduce power consumption and an error happens, it is guaranteed about high reliability. Since circuit structure is also smaller than an error correction system and error detection equipment generally has little power consumption, compared with the case where the error correction system is always operated, it becomes possible to cut down power consumption.

[0049]Efficient communication can be performed by supposing that it is possible to choose from from the error correction decoding device which is most suitable according to the gestalt of information while more than one were prepared.

[0050]Since an error correction is performed when the transmission quality is bad, reliable transmission can be performed, since an error correction is not performed when the transmission quality is good, power consumption is held down, and it becomes possible to raise a transmission rate further compared with the case where an error correction is performed.

[0051]Since information is embedded into the redundant portion of an error correcting code, since the length of a symbolic language does not change, it has seemingly the feature that a device becomes easy.

[0052]Since most suitable numerals can be chosen according to the transmission quality out of two or more error correcting codes, consumption of electric power can be held down and communicative efficiency can be gathered.

[0053]Although the receiving station side performs presumption of the transmission quality, since the transmitting station side determines what kind of operation is performed based on an estimation result, a receiver does not need to have a circuit, electric power, etc. which are needed for determination, and it becomes saving of circuit structure, power consumption, etc. When determining, in the transmitting station side, not only the report by the side of a receiving station but other various information can be used. For example, when the

position and the transmission quality of a receiving station have correlation like an electric wave, in the transmitting station side, the accuracy of presumption about the transmission quality can be raised more by making and placing the database about a position and the transmission quality.

EXAMPLE

[Example]Hereafter, the example of this invention is described with reference to drawings. Drawing 1 is a figure showing the composition of the data communication system using the radio communications system by this invention. The radio communications system by this invention is constituted by the portable electronic device provided with radio equipment, and the base station which the radio signal from a portable electronic device is received, and transmits information to a portable electronic device with a radio signal.

[0055]The radio transmission system which performs radio between a base station and a portable electronic device, The down-link access speed which signal-transmission speed receives asymmetry, and the base station 12 receives

a portable electronic device, and transmits a signal, It is an SDL (Super high speed DownLink) system more nearly high-speed than the uplink transmission speed which transmits a signal from the portable electronic device 10 to the base station 12. Here, down-link transmission is a short range (the down-link of a wide area may occur), and uplink transmission serves as a wide area.

[0056]For example, a base station uses a high bandwidth signal for down-link transmission, and provides service (multimedia service) of the communication including a picture, a sound, a file editing, information distribution and public relations, broadcast, etc., etc. to a portable electronic device. A portable electronic device uses a narrow band signal for uplink transmission, and, in the case of the information which controls a down-link, and selection of a channel and multimedia, a control signal, voice data, etc. which choose media are transmitted to a base station.

[0057]When two or more portable electronic devices exist in the area (it can communicate between portable electronic devices) which a base station covers, the circuit of uplink and a down-link is established to each portable electronic device in the possible range.

[0058]The base station is connected with the network, for example.

Service which was mentioned above via the network is acquired according to the demand from a portable electronic device, etc., and it provides for a portable electronic device.

As shown in drawing 1, a terminal (not shown) besides database system and various control systems etc. other than two or more base stations is connected to the network.

Transmission and reception of information are possible to mutual.

The portable electronic device can use the variety-of-information service through a network using the radio transmission system between base stations.

[0059]In an SDL system, in order to realize multimedia service which provides arbitrary information from arbitrary points to a portable electronic device, it can be necessary to transmit a lot of data from a base station to a portable electronic device. Therefore, it is desired for the access speed of a down-link to be high-speed as much as possible. It is desired for a portable electronic device to be small as much as possible. The miniaturization of a portable electronic device is realized by sacrificing signal-transmission speed from a portable electronic device to a base station.

[0060]A high-speed down-link is used and adoption of a TDD system is

considered in the multimedia radio communications system which provides a portable electronic device with various information from a base station. The distance of a base station and a mobile station is arbitrary, therefore the transmission from a mobile station and the transmission from other mobile stations are the purposes of making it not collide with the transmission from a base station, and the section blank in time called guard time is established in the upstream of a TDD system.

[0061]Such a multimedia radio communications system assumes the very high-speed circuit. The time by this guard time means that the time which can transmit an information signal decreases, and becomes the cause of reducing total access speed. When a TDD system is used, a base station and a portable electronic device need to use the same frequency band and signal-transmission speed. However, these restrictions apply a great burden to the transmitter of a portable electronic device, and make difficult realization of the miniaturization of the portable electronic device which constitutes a portable electronic device, and low power consumption.

[0062]In an SDL system, since it is a high speed, it is more difficult than the access speed of uplink of the access speed of a down-link to adopt TDMA/TDD

as a multiplex mode. Therefore, taking advantage of the characteristic of TDD, it will be said like a conventional system that a base transceiver station cannot presume a transmission line between a base station and a portable electronic device directly. Although it is required for a portable electronic device that composition should be simple as much as possible, that transmission-line presumption cannot be performed in a base station is a factor which checks the demand of this simplification.

[0063]In a wireless communication system with unsymmetrical access speed like an SDL system. Rather than the uplink transmission speed to which said portable electronic device transmits a signal to a base station, since the down-link access speed to which a base station transmits a signal to a portable electronic device is a high speed, To the signal transmitted from a base station to a portable electronic device, it has the problem of becoming easy to generate an error.

[0064]However, in the access speed of about tens of ksymbol/s performed conventionally, it did not become a problem. A down-link follows at high speed, and appears notably, and the influence of the transmission-line distortion by a multipass also becomes a factor which checks the transmission quality of a

down-link. When a radio communications system with unsymmetrical access speed performs multimedia service, the access speed of a down-link is the maximum and a means for becoming about hundreds of Msymbol/s to also be assumed and to compensate the error by transmission-line distortion also from this is required.

[0065]In the wireless communication system of the variable access speed currently performed conventionally. The access speed of uplink and a down-link is comparable, and since a multiplex mode is TDMA/TDD, the radio propagation characteristic between a base station and a portable electronic device shows the almost equivalent characteristic even from which direction of the communication to a portable electronic device from a base station, and the communication to a base station from a portable electronic device. However, when the system which will be the requisite is a wireless communication system with unsymmetrical access speed, the radio propagation characteristic between a base station and a portable electronic device cannot carry out transmission-line presumption in a base station rather than is [therefore] reversible. Thus, application of the conventional system to the unsymmetrical wireless communication system with which single or more figures access speed like an SDL system differs was

difficult.

[0066]Hereafter, the concrete composition which solves these problems is explained.

[0067]First, the radio communications system concerning the 1st example of an invention is explained according to drawing 2. The radio communications system of the 1st example can make the access speed of a down-link variable. Drawing 2 is a block diagram showing the composition of the base station 000 and the portable electronic device 001 of a radio communications system in the 1st example.

[0068]Although the one base station 000 and the one portable electronic device 001 are shown by drawing 2, When many portable electronic devices exist to one base station in addition to communication of a base station and a portable electronic device of 1 to 1 and two or more base stations exist to one portable electronic device, the case where two or more base stations and two or more portable electronic devices exist can be considered. Since the composition same in any case is taken, in order to explain simply, the case where many one portable electronic devices 001 exist per base station 000 is made into an example, and it explains here.

[0069]The base station 000 is constituted by the antennas 002 and 009, RF sections 033 and 008, the demodulation section 004, the access speed change-request signal detection part 005, the control section 006, and the modulation part 007. The portable electronic device 001 is constituted by the antennas 010 and 017, RF sections 011 and 016, the demodulation section 012, the propagation path estimation part 013, the control section 014, and the modulation part 015.

[0070]In the base station 000, after being received by the antenna 002 and amplifying the signal from the portable electronic device 001 by RF section 003, it gets over by the demodulation section 004. From the output signal of the demodulation section 004, the access speed change-request signal detection part 005 extracts the signal which requires change of the signal-transmission speed at the time of transmitting a signal to the portable electronic device 001 (signal-transmission speed of a down-link) from the base station 000, and outputs it to the control section 006. The signal which requires change of the signal-transmission speed of a down-link is transmitted from the portable electronic device 001. The control section 006 performs operation of changing the signal-transmission speed of a down-link, according to the output of the

access speed change-request signal detection part 005. With the output of the control section 006, the modulation part 007 changes signal-transmission speed, and outputs a modulating signal to the portable electronic device 001. In RF section 008, the modulating signal which is an output from the modulation part 007 is amplified, and it transmits from the antenna 009.

[0071]In the portable electronic device 001, after being received by the antenna 010 and amplifying the signal transmitted from the base station 000 by RF section 011, it gets over by the demodulation section 012. The propagation path estimation part 013 presumes the propagation path between the base station 000 and the portable electronic device 001 from the output of the demodulation section 012, and an estimation result is outputted to the control section 014. In the control section 014, in judging whether the signal-transmission speed of a down-link is changed from the output of the propagation path estimation part 013 and changing access speed, a change-request signal is created and it outputs to the modulation part 015. The modulated wave which is an output of the modulation part 015 is amplified by RF section 016, and is transmitted from the antenna 017.

[0072]By the above composition, the signal-transmission speed of the down-link

to the portable electronic device 001 can be changed from the base station 000.

[0073]Next, the radio communications system concerning the 2nd example of this invention is explained according to drawing 3. In the radio communications system which comprises a base station and a portable electronic device, drawing 3 shows the composition by the side of the portable electronic device 10 for deciding the access speed of the down-link from a base station. In the 2nd example, a base station side determines the access speed of a down-link.

[0074]The portable electronic device 10, The receiving antenna 11 and radio signal which receive the radio signal transmitted to the portable electronic device are chosen from a base station (not shown). Receiving RF section 12 and RF signal which carry out RF amplification. The low pass filter 15 for removing the unnecessary image after mixing by the variable frequency oscillator 13 which is a local oscillator for changing into a baseband signal, the mixer 14 which mixes the output of receiving RF section 12, and the output of the variable frequency oscillator 13, and the mixer 14, A known signal portion is detected from the data signal to which it restored by the demodulation section 16 which commits the modem which restores to the output of the low pass filter 15 to a data signal, and the demodulation section 16, By taking correlation with the output of the known

signal primary detecting element 17 and the known signal primary detecting element 17 and known signal which take out a known signal portion. Transmission line information. The output of the correlator 18 and the correlator 18 to obtain. The output of the memory 19 to buffer, the transmission-line estimation data preparing part 20 which creates the transmission-line estimation data to a base station, the control section 21 which controls the correlator 18, the memory 19, and the transmission-line estimation data preparing part 20, and the transmission-line estimation data preparing part 20. The low pass filter 23 for band-limiting and shaping in waveform the output of the modulation part 22 changed into a baseband signal, and the modulation part 22, The unnecessary image after the variable frequency oscillator 24 which is a local oscillator for carrying out upconverting to RF, the mixer 25 which mixes the output of the low pass filter 23 and the output of the variable frequency oscillator 24, and mixing is removed, It comprises the transmission antenna 27 which emits the radio signal acquired by amplification by transmitting RF section 26 and transmitting RF section 26 which amplify an RF signal to an output level to a base station.

[0075]In the portable electronic device 10, to the data signal to which it restored by the demodulation section 16, the known signal primary detecting element 17

detects the timing of the known signal included in the data signal, and notifies to the control section 21. The control section 21 to which known signal timing was notified operates the correlator 18 and the memory 19. Simultaneously with detection of known signal timing, in the known signal primary detecting element 17, a known signal portion is taken out from the data signal to which it restored. In the correlator 18, correlation of the known signal used as the known signal portion to which it restored, and the reference which it has with the portable electronic device 10 is taken, and a result is outputted to the memory 19. Since a correlation output changes with transmission line states, the base station which is not illustrated performs operation which determines the access speed of the optimal down-link from the output of this correlator 18. The portable electronic device 10 has transmitted the correlation output held at the memory 19 as information for a base station to determine access speed to a base station.

[0076]A base station can acquire information for the above composition to determine the signal-transmission speed of a down-link, and it becomes possible to communicate with the optimal access speed.

[0077]Next, the radio communications system concerning the 3rd example of this invention is explained according to drawing 4. In the radio communications

system which comprises a base station and a portable electronic device, drawing 4 shows the composition by the side of the portable electronic device 10 for deciding the access speed of the down-link from a base station. In the 2nd example, although the access speed of the down-link was determined by the base station side, in the 3rd example, it carries out in the portable electronic device 10.

[0078]The portable electronic device 10 in drawing 4 attaches identical codes about the portion equivalent to the portable electronic device 10 shown in drawing 3. The portable electronic device 10 of the 3rd example, The receiving antenna 11, receiving RF section 12, the variable frequency oscillator 13, the mixer 14, the low pass filter 15, the demodulation section 16, the known signal primary detecting element 17, the correlator 18, the memory 19, the modulation part 22, the low pass filter 23, the variable frequency oscillator 24, and the mixer 25, So that access speed may be changed based on the discriminated result by the radio propagation situation discrimination circuit 31 and the radio propagation situation discrimination circuit 31 which distinguish a radio propagation situation using the output of the memory 19 which buffered the output of the correlator 18. By the timing outputted by the access speed

change-request data creation part 31 which generates the signal required of a base station, and the known signal primary detecting element 17. It comprises the control section 32 which controls the correlator 18, the memory 19, the radio propagation situation discrimination circuit 30, and the access speed change-request data creation part 31, and the receiving-field-intensity measurement primary detecting element 33 which measures receiving field intensity.

[0079]Like the 2nd example, to the data signal to which it restored by the demodulation section 16, the known signal primary detecting element 17 detects the timing of the known signal included in the data signal, and notifies to the control section 32 in the portable electronic device 10. The control section 21 to which known signal timing was notified operates the correlator 18, the memory 19, and the radio propagation situation discrimination circuit 30. It is outputted from the correlator 18 and a correlation output is memorized by the memory 19. The radio propagation situation discrimination circuit 30 possesses the condition table for judging a radio propagation situation according to a correlation output, determines whether change the access speed of a down-link based on the condition table, and outputs that to the access speed change-request data

creation part 31. With the output of the radio propagation situation discrimination circuit 30, the access speed change-request data creation part 31 creates the code required as changing the signal-transmission speed of a down-link to a base station. This requirement signal is transmitted to a base station by an uplink signal.

[0080]Although the correlator output is used as information for access speed determination in the explanation mentioned above, it is also possible to use the receiving field intensity simultaneously detected by the receiving-field-intensity primary detecting element 33. The receiving-field-intensity primary detecting element 33 outputs a detection result to the radio propagation situation discrimination circuit 30.

[0081]By the above composition, it becomes possible to change the signal-transmission speed of a down-link, and can communicate with the optimal access speed.

[0082]Next, the radio communications system concerning the 4th example of this invention is explained according to drawing 5. Drawing 5 shows the sequence of the base station and portable electronic device in the 2nd example shown in drawing 3.

[0083]The unique word for transmission line state presumption (known information) is inserted in the signal of the down-link transmitted to a portable electronic device from a base station for every fixed time of a certain. A portable electronic device performs transmission-line presumption (40) which takes correlation with the unique word. The report (41) of the transmission-line estimation result from a portable electronic device to a base station is periodically performed according to execution of transmission-line presumption. A base station determines whether the access speed of a down-link is made to change in response to the result of transmission-line presumption notified from the portable electronic device (judgment 42 with variable access speed).

[0084]As a result of the judgment (42) with variable access speed in a base station, when the access speed of a down-link is the same as the actual condition, a base station tells only the access speed of a down-link to a portable electronic device (notice 43 of access speed). In changing access speed as a result of the judgment (42) with variable access speed, a base station tells a portable electronic device about the purport that access speed is changed and the access speed after change, and changing timing (44).

[0085]After a base station reports that access speed is changed into a portable

electronic device (44), the result is disregarded when the report (41) of a transmission-line estimation result arrives at a base station from a portable electronic device, by the time it changes signal-transmission speed (45). Transmission-line presumption (40) periodically performed in a portable electronic device is not performed immediately after the signal-transmission speed variation of a down-link (46). In a base station, if the report 41 of a portable electronic device to a transmission-line estimation result is after fixed time progress, it will be validated and judgment (42) with variable access speed will be performed. Based on the result of the judgment (42) with variable access speed, if access speed is the same as the actual condition, only access speed will be told (43). In making the signal-transmission speed of a down-link change, it tells a portable electronic device about the purport that access speed is changed at this time and the access speed after change, and changing timing (44).

[0086]Drawing 5 shows the signal-transmission speed of the down-link as an example. Before access speed change, it is 10 Msymbol/s (47) and it is shown that change signal-transmission speed to the timing which received the notice (48) which changes signal-transmission speed, and transmission is performed

by 20 Msymbol/s (49) after that.

[0087]Change of the signal-transmission speed of a down-link is attained by the above sequence.

[0088]Next, the radio communications system concerning the 5th example of this invention is explained according to drawing 6. Drawing 6 shows the sequence of the base station and portable electronic device in the 3rd example shown in drawing 4. In the 4th example, although it was opting for access speed change in the base station, in the 5th example, it opts for access speed change in a portable electronic device.

[0089]The unique word for transmission-line presumption (known information) is inserted in the signal of the down-link transmitted to a portable electronic device from a base station like the 4th example. In a portable electronic device, the time when unique word is inserted is detected and transmission-line presumption (60) is performed by taking correlation to the unique word. In a portable electronic device, it judges whether the signal-transmission speed of a down-link is changed using the result of transmission-line presumption (60) (speed variation judging 61), and in changing the signal-transmission speed set up now, it outputs a signal-transmission speed variation demand (62) to a base station. In

a portable electronic device, transmission-line presumption is not performed until there is a response from a base station to a change request.

[0090]In a base station, in response to a transmission signal speed variation demand (62), it determines whether change access speed, and change and changing timing of access speed are told to a portable electronic device (64). Access speed is changed to changing timing after that (65).

[0091]a portable electronic device -- after the signal-transmission speed variation of a down-link -- transmission-line presumption -- (65) which outputs the signal-transmission speed variation demand 62 to resume 60 and the speed variation judging 61, and change access speed further, and nothing outputs when the present access speed may still be sufficient. A base station tells the signal-transmission speed of a down-link to a portable electronic device periodically (66).

[0092]Drawing 6 shows the signal-transmission speed of the down-link as an example. Before access speed change, it is 10 Msymbol/s (67), and signal-transmission speed is changed in the timing of a notice (65) of an access speed change, and transmission is performed by 20 Msymbol/s (68) after that. Signal-transmission speed is again changed in the timing of a notice (69) of a

subsequent access speed change, and transmission is performed by 10 Msymbol/s (70).

[0093]Change of the signal-transmission speed of a down-link is attained by the above sequence.

[0094]Next, the radio communications system concerning the 6th example of this invention is explained according to drawing 7. Drawing 7 is a flow chart which shows the procedure at the time of making a down-link access speed change in a base station. Drawing 7 shows processing of the judgment 42 with variable access speed in the 4th example in which transmission-line estimation data is transmitted from a portable electronic device.

[0095]If a correlation output is notified to a base station as a transmission-line estimation result from a portable electronic device, it will start judgment with variable access speed of the flow chart shown in drawing 7. First, a base station computes the transfer characteristic between a base station and a portable electronic device using the notified correlation output (transmission-line presumption 80). A base station determines the output and the access speed r optimal from a condition table (the optimal access speed distinction 81).

[0096]Here, when the access speed r obtained by the optimal access speed

judging (81) is larger than the access speed a of the down-link set up now, the next processing is performed to (82). First, it judges whether the access speed r is over the maximum of the down-link access speed which can be set up (83), and when it is not over the maximum, processing (84) which gathers access speed is performed. On the other hand, nothing is done when the access speed r is over the maximum.

[0097]It performs the following processings, in being smaller than the access speed a to which the access speed r is set now when it is not r>a as a result of comparison (82) of the access speed r and a. First, it judges whether the access speed r is less than the minimum of the access speed of the down-link which can be set up (86), and interception processing 87 is carried out to the case of less than a minimum. On the other hand, when the access speed r is less than a minimum, processing (88) which lowers access speed is performed.

[0098]When interception processing (87) here is started, unless reception of the information from a base station is impossible for a portable electronic device and a transmission line state is recovered, in the present transmission line state, the communication to a portable electronic device from a base station becomes useless. In this invention, in order to stop communication of a down-link under

the situation which cannot communicate, it becomes possible to prevent radiation of an unnecessary electric wave. In order to start communication again after interception of the communication to a portable electronic device from a base station, it redoes from the cross connection of an initial state. The transmission quality of uplink transmitted to a base station from a portable electronic device in the unsymmetrical radio communications system whose access speed of a down-link is more nearly high-speed than the access speed of uplink is high. Therefore, even if a down-link is intercepted, the communication by uplink is possible. After communication by a down-link is intercepted by the procedure by this invention, since communication by uplink is possible, cross connection for resuming can be performed easily again.

[0099]This procedure is ended when the result of said 85 is No.

[0100]Next, the radio communications system concerning the 7th example of this invention is explained according to drawing 8. Drawing 8 shows the downlink signals and the uplink signal which are transmitted between a base station and a portable electronic device.

[0101]The access speed of a down-link is wanted to be a high speed as much as possible. In order to set up the optimal access speed, transmission-line

presumption between a base station and a portable electronic device is needed. However, as mentioned above, when an access method is not TDMA/TDD, transmission-line presumption cannot be carried out in a base station. It is desired for a portable electronic device to be simple as much as possible. Therefore, a base station changes the access speed of a down-link in the period To (90) decided beforehand, as shown in drawing 8. rate1 (91) to rate4 (94) differ in access speed, respectively. In a portable electronic device, after receiving all the access speed which a base station changes, the fastest access speed receivable with a portable electronic device is notified to a base station (access speed report 95). After that, communication is performed with the access speed which the portable electronic device notified (96).

[0102]The radio signal from a base station can be performed with whether it is ability ready for receiving checking the parity of received data with a portable electronic device, for example. Since judgment whether reception with the access speed notified only with the parity check can be performed is attained, the circuitry of a portable electronic device can be simplified.

[0103]The above enables it to set the signal-transmission speed of a down-link as an optimum value.

[0104]Next, the radio communications system concerning the 8th example of this invention is explained according to drawing 9. Drawing 9 shows the downlink signals and the uplink signal which are transmitted between a base station and a portable electronic device. In the 8th example, the signal-transmission speed variable method in the 7th example is performed further for a short time.

[0105]A base station changes the access speed of a down-link in the period To (90) decided beforehand. Under the present circumstances, it is set up beforehand and changes to the low speed one one by one from the more nearly high-speed one of the access speed. In a portable electronic device, the parity check of the signal transmitted by rate4 (100) from a base station is performed, and if it is ability ready for receiving, access speed will be notified to a base station (access speed report 101). It will not be reported if it is receive-not-ready ability. In a base station, if the report of access speed is received from a portable electronic device, it will change to the access speed.

[0106]By the above method, the access speed of a down-link can be set as an optimum value. By this method, since it receives from the fastest access speed, in the transmission line state at the time of communication, the quickest access speed can be set up in short time.

[0107]Next, the radio communications system concerning the 9th example is explained.

[0108]In a communication method with unsymmetrical access speed of uplink and a down-link, few directions of the transmission quantity of uplink are desirable. Since access speed is a low speed to uplink, this is because there is little transmission capacity of a down-link within unit time. It becomes possible to reduce the transmission quantity of uplink according to the 9th example.

[0109]Drawing 10 shows the transmission signal 110 of uplink transmitted from a portable electronic device to a base station. In the transmission signal 110, the information signal (change request signal D) for changing the access speed of a down-link periodically is included. The change request signal D (111) is 2-bit information (D1, D0), for example.

When (D1, D0) are (00), as [the present setting out] is meant (112), at the time of (01), the request of an access speed rise of a down-link is meant (113), and the request of an access speed down of a down-link is meant at the time of (10) (114).

In the state of (11), (D1, D0) show those without setting out (115).

[0110]Thus, when the variation width of the access speed set up sets up only

one per access speed change request of the down-link which transmits to a base station from a portable electronic device, the transmission quantity of uplink can be reduced.

[0111]Next, the radio communications system concerning the 10th example is explained.

[0112]By the system which realizes the multimedia by high-speed radio, the signal transmitted to a portable electronic device from a base station is considered that picture information, a sound, a text, etc. are various. These information is outputted from sources of information different original respectively, and when transmitting on radio, it is multiplexed to one signal. Generally original frequency is being used for the system clock in each sources of information by each system. In the conventional radio transmission system, the number of system clocks is one and designing so that more than one may exist is not performed. Therefore, the access speed set up with variable access speed is set as the frequency produced by carrying out dividing of the system clock. However, since the information transmitted by the system which realizes multimedia has multiplexed the information originally acquired from the sources of information of a separate system clock, if it can be responded in two or more

system clocks in a portable electronic device, it can simplify multiplexing of sources of information.

[0113]Drawing 11 shows the signal-transmission speed beforehand set up in the radio communications system of the 10th example. When making access speed change, access speed can be easily changed by creating the correspondence table of access speed as beforehand shown in drawing 11 with a base station and a portable electronic device. In the example shown in drawing 11, eight steps of access speed are set up from 10Mbps (120) to 70Mbps (121). When a portable electronic device wants to set the signal-transmission speed of a down-link as 10Mbps, the control code 01 is transmitted. In a base station, access speed is set to 10Mbps according to the signal-transmission speed set as the access speed correspondence table shown in drawing 11.

[0114]The access speed which is not an integral multiple of a system clock is contained in the access speed correspondence table. In drawing 11, it is being referred to as 53.24Mbps as an example (122). In the multi media communication system that many sources of information of the signal transmitted as explained previously exist, it is assumed that two or more different system clocks exist. In that case, in order to carry out multiplex [of the data from

two or more sources of information] to a transmission signal and to make it coexist with the data from other sources of information, it is necessary to coincide the access speed of a signal. The staph synchronization etc. which insert an unnecessary bit are raised as a conventional example of this method.

[0115]In the communication method concerning this invention, since signal-transmission speed is variable, it can multiplex by making signal-transmission speed change for every data from different sources of information. That is, multiplexing becomes possible about the system clock (for example, 122) of each sources of information by entering the correspondence table of access speed, as shown in drawing 11.

[0116]Drawing 12 is the 11th example that showed the composition of the recovery machine in the portable electronic device at the time of performing multimedia communication with two or more sources of information from which a system clock differs. It is received by the antenna 130 and the radio signal transmitted from the base station is decoded by the baseband signal by MODEM131. The control section 132 supervises the output of MODEM131, changes the switch 133 according to the kind of sources of information, and operates a decoding part corresponding from two or more decoding parts 134.

Each decoding part 134 possesses PLL134 for clock synchronization, and decodes the data of each sources of information from the baseband signal inputted. It becomes possible to multiplex the signal of sources of information with which system clocks differ by changing signal-transmission speed by the above composition.

[0117]Next, the radio communications system concerning the 12th example of this invention is explained according to drawing 13. Drawing 13 shows the generation method of the signal for transmission error detection.

[0118]It can ask for the maximum access speed by presuming a transmission line state. Presumption of a transmission line state is performed using an input signal and a known signal. Generally, presumption of a transmission line needs huge calculation. It is possible to perform a signal transmission using a control channel between a base station and a portable electronic device, and to check the transmission quality in this invention. Therefore, access speed is changed, a signal is transmitted and it becomes possible to presume a transmission line state by detecting the digital error of a demodulation signal.

[0119]In drawing 13, 2 bits of check bits 142 are first added to the data 141 of a triplet by rate1. In rate2, 5 bits containing the data division 141 and the check bit

142 of rate1 are changed into 10 bits (143) with the access speed of rate2, and the check bit 144 is added to these 10 bits (143). In rate3, 12 bits of 143 and 144 are changed into 24 bits (145) with the access speed of rate3, 24 bits (145) are received, and the check bit 146 is added. Thus, it restores to the generated digital-error detecting signal with each access speed, and it becomes possible to determine access speed by the thing of each access speed to do for a check bit inspection.

[0120]Next, the radio communications system concerning the 13th example is explained. Drawing 14 shows a part of signal of the control channel by the 12th example. As shown in the 4th example, when a base station changes the access speed of a down-link, it tells the signal-transmission speed and changing timing (alteration time) after change. Drawing 14 shows the composition of the signal for notifying signal-transmission speed and changing timing.

[0121]First, the change code 150 which means being a notification signal at the time of changing signal-transmission speed into the signal of a down-link is sent out, and the information 151 (here, it may be 4 bits) which shows the signal-transmission speed rate after changing into the next is sent out. Next, the information 152 (here, it may be 8 bits) which shows access speed changing

timing is transmitted. By the access speed changing timing 152, after what bit is transmitted from the change code 150, it is shown whether signal-transmission speed is changed.

[0122]It enables a base station to notify the signal-transmission speed and change timing of a down-link by the above method.

[0123]Next, the radio communications system concerning the 14th example of this invention is explained according to drawing 15. Drawing 15 shows the sequence of the base station and portable electronic device in the 14th example.

[0124]In order to presume the line characteristic of a down-link, the known sign 160 is inserted in the signal of the down-link transmitted to a portable electronic device from a base station. In a portable electronic device, a line characteristic is presumed based on the known signal 160, and it determines whether change the signal-transmission speed of a down-link. Simultaneously with transmission-line presumption, with the portable electronic device, it restored to the received wave sent from a base station, and information has been acquired. In changing the signal-transmission speed of a down-link, it outputs the access speed change request 161 to a base station. In the example shown in drawing 15, the signal-transmission speed to receive is changed at the same time it

outputs the access speed change request 161. Therefore, it cannot restore to a received wave until it is transmitted from a base station with the same access speed as the signal-transmission speed which a portable electronic device is receiving. In a base station, the signal-transmission speed of a down-link is changed according to the access speed change request 161 (162). In a portable electronic device, downlink signals after signal-transmission speed was changed are received, and the recovery of a signal which received is resumed (163).

[0125]The above sequence enables it to change the signal-transmission speed of a down-link. In the 4th example, it changes from a base station by transmitting the timing which changes the signal-transmission speed of a down-link to a portable electronic device. In the 14th example, since a change is immediately performed to the signal-transmission speed variation demand from a portable electronic device, it becomes possible to follow a quick transmission line change.

[0126]When a portable electronic device changes the access speed of a received wave simultaneously with the change request of signal-transmission speed like the 14th example, When a change request is not transmitted to a base station by the digital error, since the signal-transmission speed at the time of reception with a portable electronic device differs from the signal-transmission

speed at the time of transmission of a base station, communication by a down-link becomes impossible. The following methods are effective in order to avoid this.

[0127]First, if the 1st supervises the signal from a fixed time base station and is unreceivable after a portable electronic device's transmitting the change request of signal-transmission speed, it is the method of returning to the original access speed. The 2nd is the method of providing two or more demodulation sections so that a portable electronic device can receive two or more different signal-transmission speed.

[0128]In the 1st method, since a portable electronic device returns again after the fixed time which outputted the signal-transmission speed variation demand at the signal-transmission speed in front of a change request, there is a fault in which the transmission quality is not improved. For the solution, the method of telling signal-transmission speed by a control channel is taken. That is, the aforementioned problem is solved by telling a portable electronic device about the access speed of the signal transmitted from a base station. two or more demodulation sections are provided in the 2nd method -- by the ability to kick, since there is nothing if it is ****, realization of a miniaturization of a portable

electronic device is made difficult. However, it becomes possible by taking the above composition to improve the transmission quality.

[0129]As explained in full detail above, in a communication method with unsymmetrical access speed of uplink and access speed of a down-link, the access speed of a down-link can be changed according to the propagation situation between a base station and a portable electronic device. This enables it to secure the transmission quality of a down-link.

[0130]If only the circuit which presumes a transmission line state in a portable electronic device is provided, it will become possible to grasp a propagation situation in a base station, and it will become possible to realize variable access speed also with access methods other than TDMA/TDD. If the circuit which performs judgment to which access speed is changed in a portable electronic device is provided, unnecessarily, more, notifying the propagation situation of a down-link to a base station can reduce the transmission quantity of uplink, and it can improve a synthetic throughput.

[0131]According to this invention which was decided beforehand and which changes the access speed of a down-link for every period, and asks for the optimal access speed, it becomes possible to simplify the circuit which presumes

a transmission line state. It becomes possible to shorten the time required in order to ask for the optimal access speed.

[0132]The access speed of uplink becomes possible [solving the problem of transmission capacity reduction of uplinks generated according to a low thing] compared with the access speed of a down-link. It becomes possible to decrease useless wireless transfer unreceivable with a portable electronic device.

[0133]In the multimedia service which transmits the signal of two or more sources of information with which system clocks differ, it becomes possible to multiplex the information from which a system clock differs. It becomes possible to make easy a change of the access speed in a portable electronic device by notifying the access speed after the timing which changes the access speed of a down-link, and change.

[0134]Next, in order to secure the high transmission quality and to improve the reliability of information and telecommunications, the radio communications system which performs communication which used the error correcting code is explained. Below, securing the high transmission quality using an error correcting code, power consumption is reduced, and composition of a simple

portable electronic device is enabled, and improvement in the whole transmission efficiency is aimed at.

[0135]The radio communications system concerning the 15th example of this invention is explained. In the radio communications system which comprises a base station and a portable electronic device, drawing 16 is a block diagram showing the composition of the error correction system formed in the portable electronic device.

[0136]The error correction system in a portable electronic device, The radio signal transmitted to the portable electronic device from the base station (not shown). From a radio signal to the receiving antenna 201 and a data signal to receive. The receiving set 202 changed into a (symbol string), the transmission-quality estimating device 203 which presumes the transmission quality of the transmission line between a base station and a portable electronic device, the switch controller 204 which performs switching control of the switches 205a and 205b according to the estimation result by the transmission-quality estimating device 203, The switches 205a and 205b which change the course of the data signal outputted from the receiving set 202 to any of the redundancy stripper 206 or the error correction decoding device 207 they

are, It comprises the redundancy stripper 206 which removes the redundant portion (error correcting code) for the error correction in a data signal, the error correction decoding device 207 which performs error correction decoding to a data signal, and the processing unit 208 which performs various processing about a data signal.

[0137]The signal transmitted from a base station is made from the 15th example from the symbol string error-correcting-code-ized using the numerals which can acquire an information series only by removing redundancy. An error can be started in the radio transmission line from a base station to a portable electronic device. The transmission-quality estimating device 203 presumes the transmission quality of a transmission line, and controls whether a symbol string is processed by the switch controller 204 with an error correction system, or it is processed by the redundancy stripper. Usually, in order to secure the high transmission quality, as shown in drawing 16, the switches 205a and 205b are changed to the error correction decoding device 207 side, and a data signal is processed by the error correction system.

[0138]In drawing 16, it is drawn as if the receiving set 202 received the electric wave, but they may be transmission media other than an electric wave.

[0139]Drawing 17 shows the composition of the transmission-quality estimating device 203 in the 15th example of an invention. Generally, while exact measurement of the transmission quality is difficult, cost starts. For this reason, the transmission-quality estimating device 203 for facilitation of transmission-quality presumption, Distribution of the measurement result of the high physical development of the transmission quality and correlation, i.e., (1) receiving field intensity, and (2) eye patterns, detection of (3) known patterns (unique word (known information)), the error rate after (4) reception, and (5) and others independently, Or by combining, the transmission quality is presumed and switch-off substitute control is directed to the switch controller 204.

[0140](1), for example from the receiving set 202, input measurement of receiving field intensity and the transmission quality by (2) eye patterns about the data about each, and perform it. As measurement of the transmission quality by (3) known patterns (unique word (known information)) is shown, for example in the 4th example and the 5th example, it is performed. Namely, the known pattern for transmission-quality presumption of a transmission line is inserted in the downlink signals transmitted from the base station, and it carries out by detecting this known pattern. To drawing 16, the known signal primary detecting

element for detecting a known pattern is not illustrated. (4) The error detection after performing the redundancy removal by the redundancy stripper 206 or the error correction by the error correction decoding device 207, for example performs measurement of the transmission quality by an after-reception error rate.

[0141]Here, the transmission-quality measuring device 203 shall direct control of a switch-off substitute based on the bit error rate acquired by (3) known patterns and the error rate after (4) reception. In this case, the judgment based on a bit error rate will be performed in two steps error correction before and after an error correction. The transmission-quality measuring device 203 compares with a bit error rate the threshold (reference quality) set up beforehand, and, as a result, when a bit error rate is larger than a threshold, It directs to change the switches 205a and 205b to the error correction decoding device 207 side to the switch controller 204. When the bit error rate of the transmission-quality measuring device 203 is below a threshold as a result of comparison, it directs to change the switches 205a and 205b to the redundancy stripper 206 side to the switch controller 204. Under the present circumstances, the threshold to a bit error rate is set as two steps in consideration of coding gain. That is, in the judgment after

an error correction, naturally, since the bit error rate is low, a threshold is also set up according to it.

[0142]For example, if the power consumption which operation of the redundancy stripper 206 takes considers it as a sufficiently small thing as compared with the power consumption which operation of the error correction decoding device 207 takes, If the frequency exceeding a threshold is a half as a result of comparison with the bit and error rate in the transmission-quality measuring device 203, and a threshold, the power consumption which decoding takes will be reduced in a half. Therefore, since the power consumption of an electronic portable instrument is reduced, it becomes possible to simplify composition.

[0143]The algorithm for opting for operation of an error correction system based on the point estimate of transmission line quality in the 15th example is shown in drawing 18 thru/or drawing 20. The point estimate (xt) of the transmission quality in the time t called for by the transmission-quality estimating device 203 as shown in drawing 18, As a result of comparing a threshold (reference quality), when xt is below a threshold, since it is redundant, performing an error correction suspends an error correction, and it aims at reduction of power consumption. When xt exceeds a threshold, an error correction is operated in

order to secure the high transmission quality. He is trying for adding an inertial term to the algorithm shown in drawing 18 further, and also referring to the past n times of point estimates to raise the accuracy of the point estimate of the transmission quality in the algorithm shown in drawing 19. The algorithm shown in drawing 20 enables it to reduce the storage capacity of the past point estimate by making an inertial term become a relation of an exponent.

[0144]Drawing 21 and drawing 22 show the example of composition of the concatenated code in the case of using a concatenated code, in order to measure an after-reception error rate in the 15th example.

[0145]In the composition shown in drawing 21, the redundancy which consists of error detecting code CRC (211) and error correcting code ECC (212) is added to the information bit 210. The information bit 210 is error-correcting-code-ized after being coded by error detecting code CRC (211). The error detection after performing an error correction or redundancy removal performs presumption of an after-reception error rate. However, it does not perceive about the error contained in a redundant portion in this case. It becomes possible to heighten error correction capability when the error correction system is operating by using the numerals which can perform error detection and an error correction

simultaneously instead of [other than composition of being shown in drawing 21] an error detecting code, for example, a BCH code etc. As numerals which can take out an information series from a symbolic language easily even if it does not perform an error correction, there are systematic numerals and Invertible numerals, QLI numerals, etc.

[0146]In the composition shown in drawing 22, the redundancy which consists of error correcting code ECC (214) and error detecting code CRC (215) is added to the information bit 213. After the error correction of the information bit 213 is carried out by error correcting code ECC (214), it is coded by error detecting code CRC (215). Presumption of an after-reception error rate performs error detection by error detecting code CRC (215) first. Then, redundancy removal or an error correction can be performed. It becomes possible to heighten error correction capability when the error correction system is operating by using, the numerals which can perform error detection and an error correction simultaneously instead of, for example, a BCH code etc., etc. [error detecting code CRC]

[0147]Drawing 23 shows another example of composition of the error correction system in the 15th example. In drawing 23, the numerals which use syndrome

as error correction decoding are used. When the numerals using syndrome are used, decoding is performed in two steps, the syndrome computing device 221 and the error pattern generating device 225, and it can be detected whether the error is contained in the symbolic language by syndrome. An after-reception error rate can be used for presumption of the transmission quality by using syndrome calculation as an error detection mechanism. According to this composition, since it does not independently have an error detection mechanism, it becomes reduction of circuit structure.

[0148]Next, it explains, referring to drawing 24 for the 16th example of this invention. Drawing 24 is a block diagram showing the composition of the error correction system in the 16th example. Identical codes are attached about the error correction system and identical parts of the 16th example which are shown in drawing 16, and explanation is omitted.

[0149]There is a means to control error correction capability besides the control using the transmission-quality information by the transmission-quality estimating device 203. For example, since the electronic personal digital assistant is used, the remainder of the electric power of a terminal has decreased and an error may be permitted, consumption of electric power is reducible because it is made

not to perform error correction decoding by control from the outside in the situation of liking to get information to the last compulsorily. According to the importance of the information which is communicating, the tolerance of an error is also controllable according to the directions from a user. It is also possible to perform control by an OSI hierarchy's high order hierarchy.

[0150]Next, it explains, referring to drawing 25 for the 17th example of this invention. Drawing 25 is a block diagram showing the composition of the error correction system in the 17th example. Identical codes are attached about the error correction system and identical parts of the 16th example which are shown in drawing 16, and explanation is omitted.

[0151]The reliability of information can be guaranteed, such as performing error detection and performing resending control according to the result with the error detection equipment 228, before redundancy removal, even when the error correction decoding device 207 does not perform an error correction. An error signal is transmitted to a high order hierarchy (drawing 25 processing unit 208). The processing unit 208 controls an electronic portable instrument to perform request sending of information to a base station.

[0152]For example, such a mechanism can be realized by using the numerals

which can perform both an error correction and error detection, for example, a BCH code, without dropping a transmission rate.

[0153]Next, it explains, referring to drawing 26 for the 18th example of this invention. Drawing 26 is a block diagram showing the composition of the error correction system in the 18th example. Identical codes are attached about the error correction system and identical parts of the 16th example which are shown in drawing 16, and explanation is omitted. The error correction system 233-1 which has several capability to have differed, respectively in the error correction system shown in drawing 26 - 233-n are provided.

[0154]When multimedia service is realized by the down-link from a base station, various existence of some gestalten, for example, a sound, the picture, etc. is recognized at the information transmitted from a base station to an electronic portable instrument. In an electronic portable instrument, the switch controller 230 functions so that a most suitable error correction system may be chosen from two or more error correction systems 233-1 - 233-n according to the gestalt of the transmitted information. Although it is necessary to get to know which gestalt the information on is sent in the electronic portable instrument side, this can be directed using the information added to the information which is told

beforehand or is transmitted in forms, such as a header. The switch controller 230 changes the switches 231a and 231b so that the gestalt of the information transmitted may be distinguished and an error correction may be performed by a corresponding error correction decoding device. . This changes the degree of an error correction with a sound according to the importance over listening comprehension, for example according to human being's aural characteristic. Or in transmission of a picture, since information important for the dc component after performing orthogonal transformation is included, error correcting code-ization with high capability can be performed, and the alternating current component can choose the error correcting system of the form where it was suitable according to the gestalt of information, such as raising a rate with performing an error correction with low capability.

[0155]Next, it explains, referring to drawing 27 for the 19th example of this invention. Drawing 27 is a block diagram showing the composition of the radio communications system using the error correction system in the 19th example.

[0156]A receiving station (electronic gestalt device) controls operation for an error correction system by presuming the quality of a transmission line with the transmission-quality estimating device 243, controlling execution of the error

correction by the error correction decoding device 246 according to an estimation result, and performing a negotiation between transmitting stations (base station).

[0157]It supposes that an error correction is not performed when judged with the transmission quality being inferior to reference quality, and an error correction is performed when judged with fulfilling reference quality.

[0158]Drawing 28 shows the example of the negotiation of the transmitting station and receiving station in the radio communications system of the 19th example. The receiving station which detected degradation of the transmission quality opts for use of the error decoding correction device 246, and transmits the notice of transmission-quality degradation for urging use of the error correction decoding device 246 to a transmitting station. A transmitting station notifies a receiving station that the notice of transmission-quality degradation was received, the error correcting code-ized device 256 was operated, and the error correcting code-ized device 256 was operated. Since it turns out that the signal to receive is error-correcting-code-ized, the receiving station which received the notice changes the switches 245a and 245b with the transmission-quality estimating device 243, and it is operation **** about the

error correction decoding device 246.

[0159]It can be judged that the information received in the period after detecting degradation of transmission line quality until the error correction decoding device 246 operates lacks in reliability remarkably. Therefore, reliability can be improved by throwing away the information on this period.

[0160]The receiving station which detected that transmission line quality had been improved notifies the non-use of the error correction decoding device 246 to a transmitting station. The transmitting station which received the notice suspends operation of the error correcting code-ized device 256, and notifies the receiving station side that it stopped. The receiving station which received the notice stops operation of the error correction decoding device 246.

[0161]Improvement in the transmission rate by drawing 29 not performing the coding in the communications system which used the error correction system of the 19th example is shown. While the error correction system is not operating, by not transmitting the redundant portion by error-correcting-code-izing, code length is shortened and a transmission rate is raised.

[0162]Drawing 30 shows improvement in a transmission rate when information is embedded at the redundancy part by error-correcting-code-izing in the

communications system which used the error correction system of the 20th example. A transmission rate is raised with replacing with the redundant portion by error-correcting-code-izing, and embedding an information bit while the error correction system is not operating.

[0163]Drawing 31 is a block diagram showing the composition of the communications system using the error correction system in the 21st example. Two or more error correction decoding devices 255-1 which responded to the difference in the transmission quality - 255-n are provided in the error correction system in the 21st example.

[0164]For example, there are the numerals A for high error rates and the numerals B for low error rates, and the error correction decoding device corresponding to each is formed. Usually, the numerals B are used, when it is expected that an error becomes high, it switches to the numerals A, and when an error rate is expected that an error hardly arises low, it will transmit, after coding with the numerals B, and an error correction will not be performed, or the coding itself will be stopped.

[0165]Suitable numerals differ in a transmission line with many errors of burst nature, and a transmission line with many errors of random nature. In this case,

the kind of error also needs to recognize a transmission-quality estimating device.

[0166]In a portable electronic device, it is used according to the change of numerals, choosing an error correction decoding device corresponding from two or more error correction decoding devices 255-1 - 255-n. Optimal control of power consumption is performed maintaining fixed reliability by choosing an error correction decoding device by the estimation result of the transmission quality by the transmission-quality estimating device 203. A redundancy stripper may also be included in a decoding device. An error correction system suitable for the reliability demanded can also be chosen.

[0167]Drawing 32 shows the block diagram showing the composition of the communications system using the error correction system in the 22nd example. The error correction system of the 22nd example communicates with the base station 260, and raises the accuracy of presumption of the transmission quality by cooperating. For example, I send the measurement result of the high physical development of the transmission qualities, such as receiving field intensity, and correlation, have complicated calculation which is possible only for the base station 260 performed to the base station 260, and have the result returned, and

the switches 205a and 205b are controlled by the switch controller 227. Since the base station 260 can acquire more extensive information, it can raise the accuracy of presumption about the transmission quality. The base station 260 can use the result of the past about the relation between a place, time, etc. and the transmission quality using database 261 grade. For example, when using the same transmission line by transmission and reception like TDD by radio, the transmission-quality estimating device 271 can be simplified by having measurement of a part of quality measurement (influence of shadowing to a transmission line, etc.) of a transmission line contracted.

[0168]The portable electronic device of easy composition of that power consumption can be saved can be provided guaranteeing the reliability of information by controlling error correction capability accommodative, if the error correction system of this invention is used, as explained in full detail above.

[0169]It not only uses an error correction system independently, but it becomes possible by incorporating as some radio communications systems to heighten an effect in respect of power consumption and communication efficiency further.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The figure showing the composition of the data communication system using the radio communications system by this invention.

[Drawing 2]The figure showing the composition of the base station and portable electronic device concerning the 1st example of this invention.

[Drawing 3]The block diagram showing the composition of the portable electronic device concerning the 2nd example of this invention.

[Drawing 4]The block diagram showing the composition of the portable electronic device concerning the 3rd example of this invention.

[Drawing 5]The figure showing the protocol of the base station and portable electronic device concerning the 4th example of this invention.

[Drawing 6]The figure showing the protocol of the base station and portable electronic device concerning the 5th example of this invention.

[Drawing 7]The flow chart which shows the procedure of the down-link access speed change in the base station concerning the 6th example of this invention.

[Drawing 8]The figure showing the down-link and uplink signal concerning the

7th example of this invention.

[Drawing 9]The figure showing the down-link and uplink signal concerning the 8th example of this invention.

[Drawing 10]The figure showing the uplink signal concerning the 9th example of this invention.

[Drawing 11]The figure showing the access speed of a down-link and the table of a code concerning the 10th example of this invention which were defined beforehand.

[Drawing 12]The figure showing the composition of the portable electronic device concerning the 11th example of this invention.

[Drawing 13]The figure showing the generation method of the signal for the transmission error detection concerning the 12th example of this invention.

[Drawing 14]The figure showing the composition of the signal which notifies change and changing timing of the access speed of transmitting [to a portable electronic device]-from base station concerning 13th example of this invention down phosphorus.

[Drawing 15]The figure showing the protocol of the base station and portable electronic device concerning the 14th example of this invention.

[Drawing 16]The block diagram showing the composition of the error correction system formed in the portable electronic device of the radio communications system concerning the 15th example of this invention.

[Drawing 17]The figure showing the composition of the transmission-quality estimating device in the 15th example of this invention.

[Drawing 18]The figure showing the algorithm for opting for operation of an error correction system based on the point estimate of the transmission line quality in the 15th example of this invention.

[Drawing 19]The figure showing the algorithm for opting for operation of an error correction system based on the point estimate of the transmission line quality in the 15th example of this invention.

[Drawing 20]The figure showing the algorithm for opting for operation of an error correction system based on the point estimate of the transmission line quality in the 15th example of this invention.

[Drawing 21]The figure showing the example of composition of the concatenated code in the case of using a concatenated code in order to measure an after-reception error rate in the 15th example of this invention.

[Drawing 22]The figure showing the example of composition of the concatenated

code in the case of using a concatenated code in order to measure an after-reception error rate in the 15th example of this invention.

[Drawing 23]The block diagram showing another example of composition of the error correction system in the 15th example of this invention.

[Drawing 24]The block diagram showing the composition of the error correction system in the 16th example of this invention.

[Drawing 25]The block diagram showing the composition of the error correction system in the 17th example of this invention.

[Drawing 26]The block diagram showing the composition of the error correction system in the 18th example of this invention.

[Drawing 27]The block diagram showing the composition of the radio communications system using the error correction system in the 19th example of this invention.

[Drawing 28]The figure for explaining the example of the negotiation of the transmitting station in the radio communications system of the 19th example of this invention, and a receiving station.

[Drawing 29]The figure for explaining improvement in the transmission rate in the communications system using the error correction system of the 19th

example of this invention.

[Drawing 30]The figure for explaining improvement in the transmission rate in the communications system using the error correction system of the 20th example of this invention.

[Drawing 31]The block diagram showing the composition of the communications system using the error correction system in the 21st example of this invention.

[Drawing 32]The block diagram showing the composition of the communications system using the error correction system in the 22nd example of this invention.

[Drawing 33]The figure for explaining selection of the modulation parameter in the conventional radio communications system.

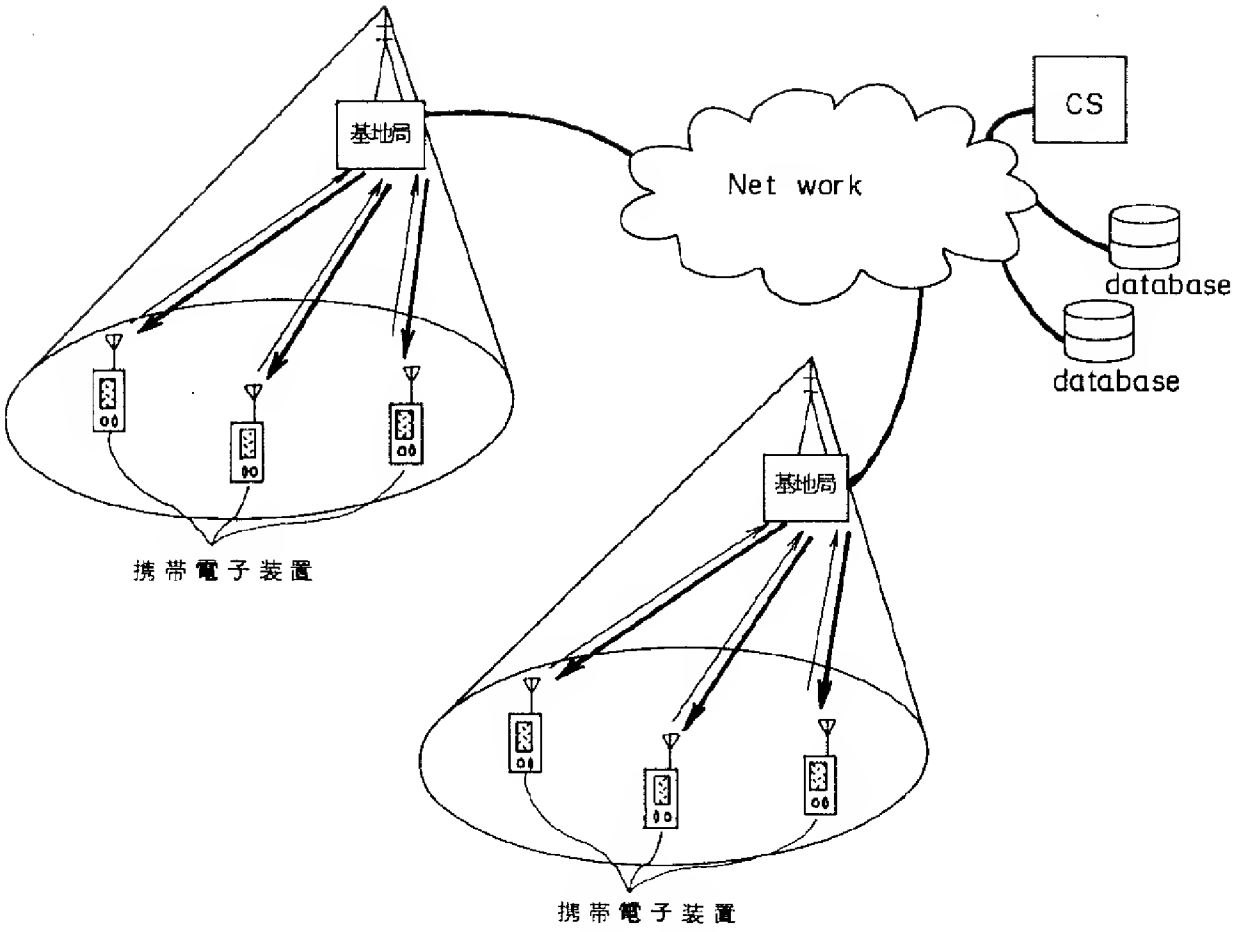
[Description of Notations]

000 -- A base station, 002-009-010, 017 -- An antenna, 033-001-011, 016 -- RF section, 004, 012 -- A demodulation section, 005 -- An access speed change-request signal detection part, 006 -- Control section, 007, 015, 22 -- A modulation part, 001 -- A portable electronic device, 013 -- Propagation path estimation part, 014 -- A control section, 10 -- A portable electronic device, 11,201 -- Receiving antenna, 12 -- Receiving RF sections 12, 13, and 24 -- A variable frequency oscillator, 14, 25 -- Mixer, 15, 23 -- A low pass filter, 16 -- A

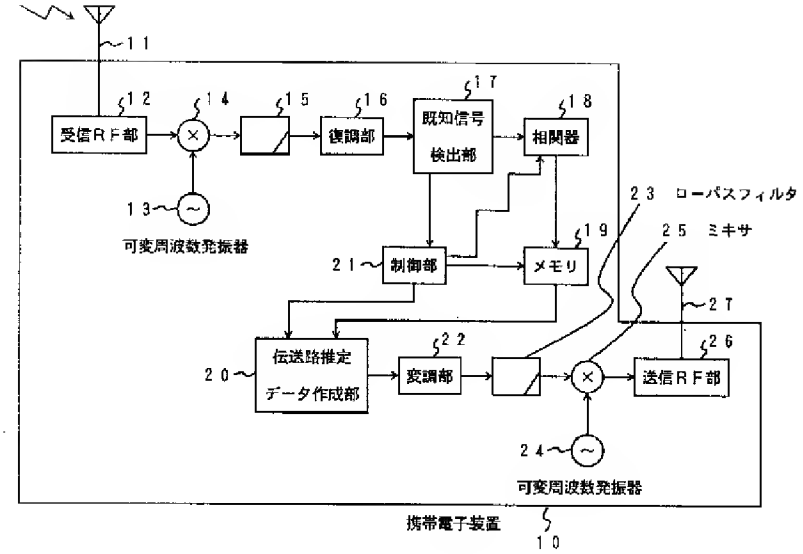
demodulation section, 17 -- Known signal primary detecting element, 18 [-- Control section,] -- Correlator, 19 -- A memory, 20 -- A transmission-line estimation data preparing part, 21 26 -- A transmitting RF section, 27 -- A transmission antenna, 30 -- Radio propagation state decision circuit, 31 -- An access speed change-request data creation part, 33 -- Receiving-field-intensity primary detecting element, 202 -- A receiving set, 203 -- A transmission-quality estimating device, 205a, 205b, 231a, 231b -- Switch, 204,224 [-- A processing unit, 221 / -- A syndrome computing device, 225 / -- An error pattern generating device, 228 / -- Error detection equipment,] -- A switch controller, 206 -- A redundancy stripper, 207,233-1 - 233-n, 255-1 - 255-n -- An error correction decoding device, 208 256 -- An error correcting code-ized device, 261 -- Database.

DRAWINGS

[Drawing 1]



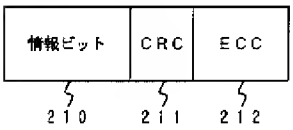
[Drawing 3]



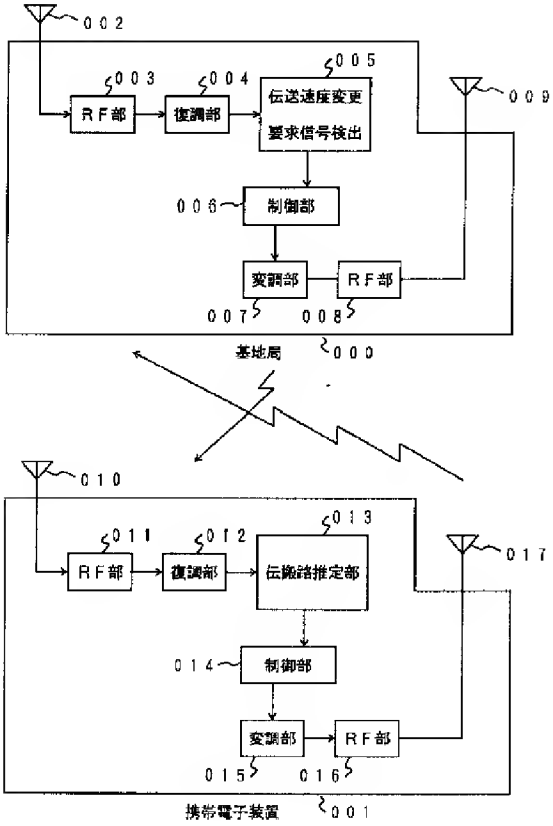
[Drawing 11]

コード	信号伝送速度 (bps)	
01	10M	120
02	20M	
03	30M	
04	40M	
05	50M	
11	53.24M	122
06	60M	
07	70M	121

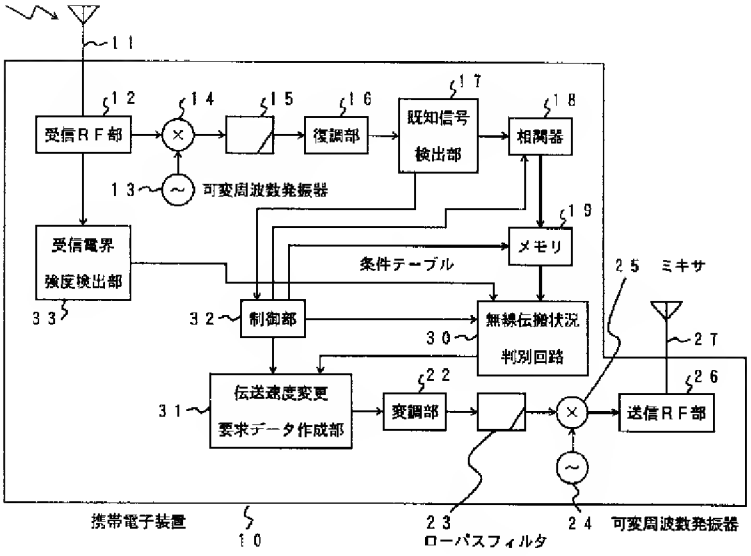
[Drawing 21]



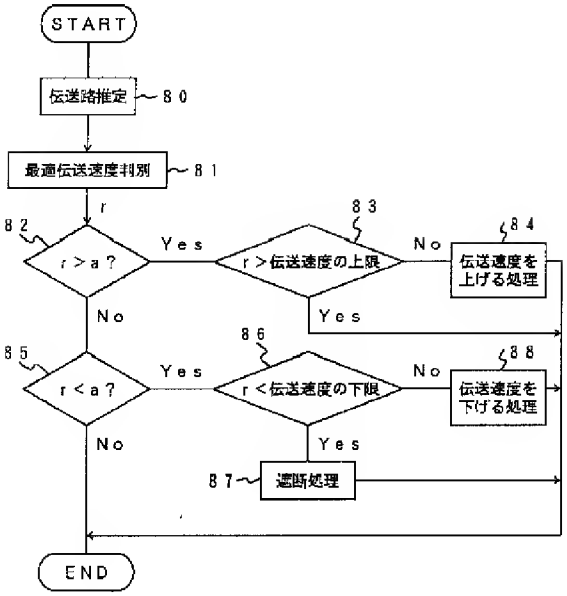
[Drawing 2]


002
003
004
005
RF部
復調部
伝送速度変更
要求信号検出
009
006
制御部
変調部
RF部
007
008
基地局
000
010
011
012
013
RF部
復調部
伝搬路推定部
017
014
制御部
変調部
RF部
015
016
携帯電子装置
001

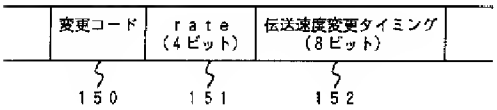
[Drawing 4]


11
12
14
15
16
17
18
受信RF部
復調部
既知信号
検出部
相関器
13
可変周波数発振器
19
メモリ
受信電界
強度検出部
条件テーブル
25
ミキサ
33
32
制御部
無線伝搬状況
判別回路
30
27
伝送速度変更
要求データ作成部
31
22
変調部
26
送信RF部
携帯電子装置
10
23
ローパスフィルタ
24
可変周波数発振器

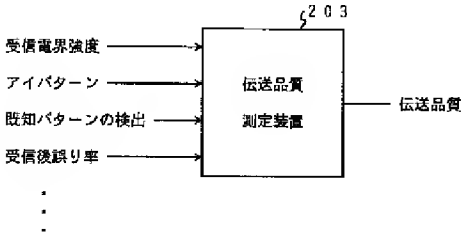
[Drawing 7]



[Drawing 14]



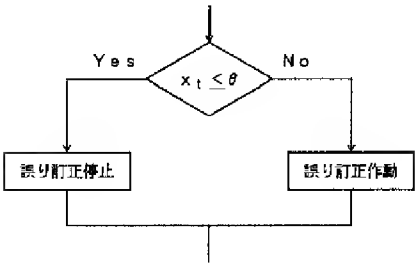
[Drawing 17]



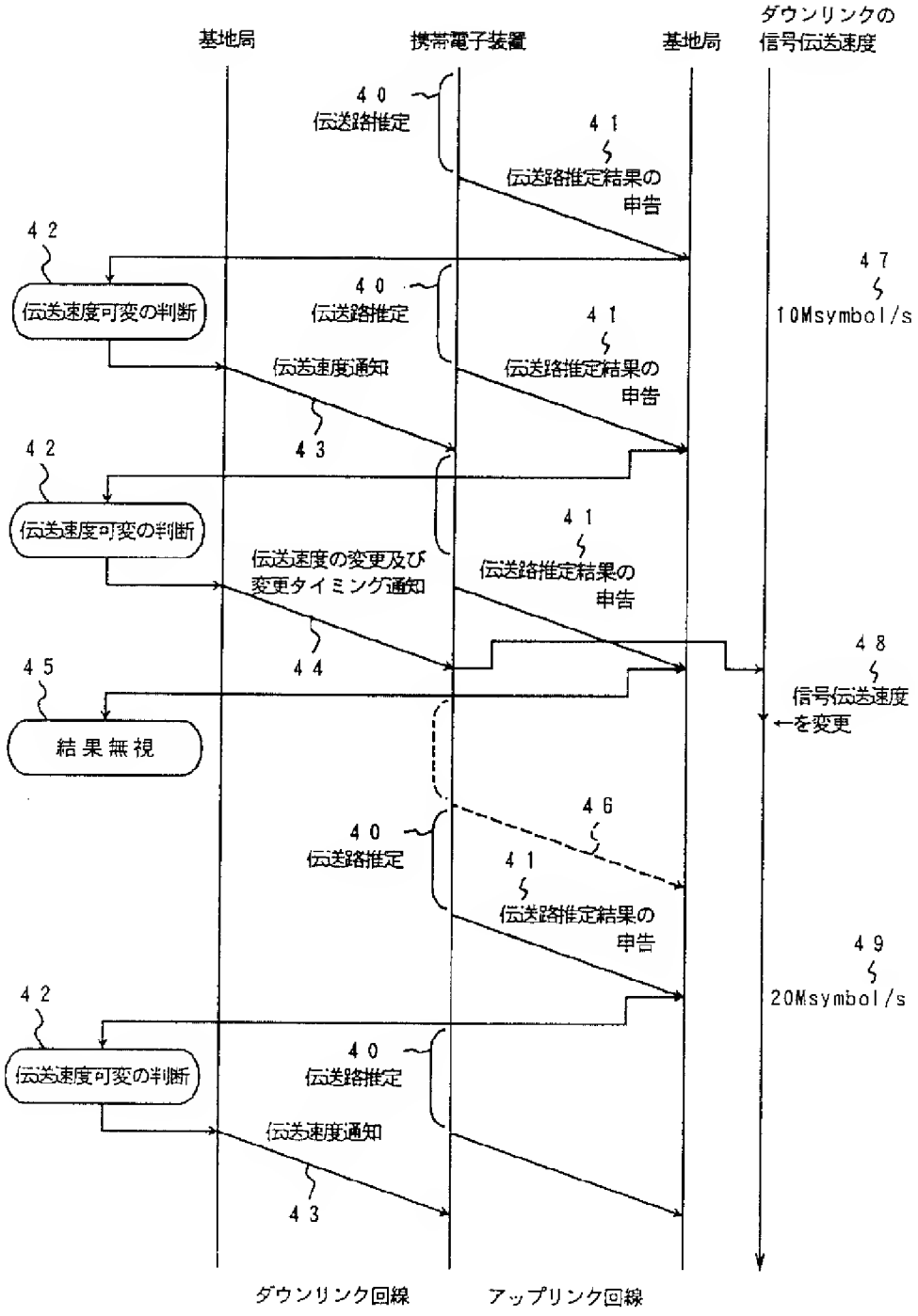
[Drawing 18]

x_t ：時刻 t における伝送路品質の推定値（0～1）

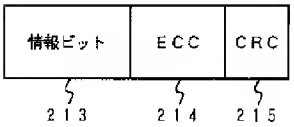
θ ：しきい値（基準品質）



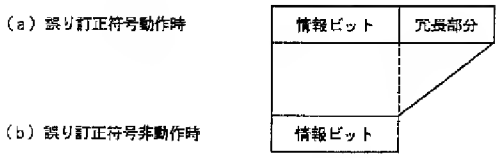
[Drawing 5]


基地局
携帯電子装置
基地局
ダウンリンクの
信号伝送速度
40
伝送路推定
41
伝送路推定結果の
申告
42
伝送速度可変の判断
40
伝送路推定
41
伝送路推定結果の
申告
47
10Msymbol/s
伝送速度通知
43
42
伝送速度可変の判断
41
伝送速度の変更及び
変更タイミング通知
伝送路推定結果の
申告
44
48
信号伝送速度
←を変更
45
結果無視
46
40
伝送路推定
41
伝送路推定結果の
申告
49
20Msymbol/s
42
伝送速度可変の判断
40
伝送路推定
伝送速度通知
43
ダウンリンク回線
アップリンク回線

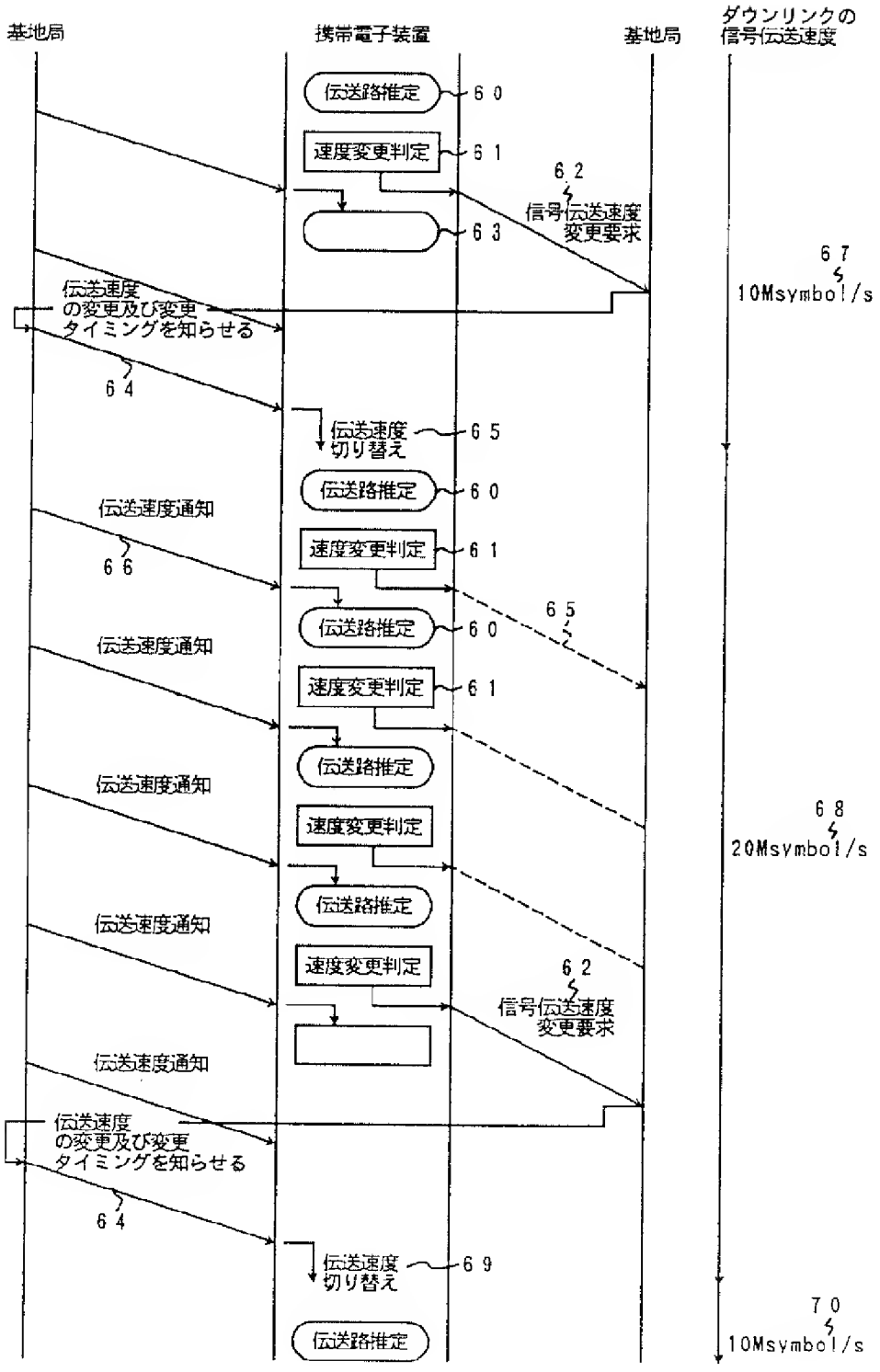
[Drawing 22]



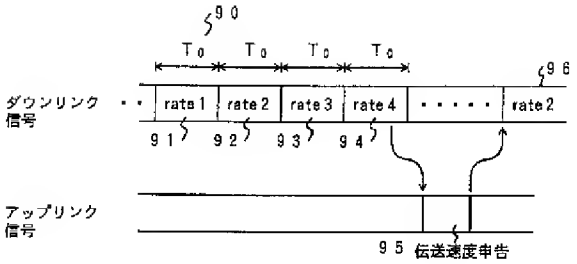
[Drawing 29]



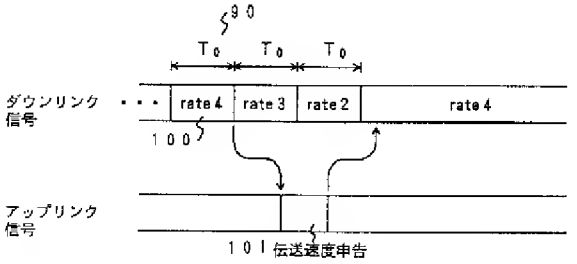
[Drawing 6]


基地局
携帯電子装置
基地局
ダウンリンクの
信号伝送速度
伝送路推定
60
速度変更判定
61
62
信号伝送速度
変更要求
63
67
10Msymbol/s
伝送速度
の変更及び変更
タイミングを知らせる
64
伝送速度
切り替え
65
伝送路推定
60
伝送速度通知
66
速度変更判定
61
伝送路推定
60
65
伝送速度通知
速度変更判定
61
伝送路推定
伝送速度通知
速度変更判定
68
20Msymbol/s
伝送路推定
伝送速度通知
速度変更判定
62
信号伝送速度
変更要求
伝送速度通知
伝送速度
の変更及び変更
タイミングを知らせる
64
伝送速度
切り替え
69
伝送路推定
70
10Msymbol/s

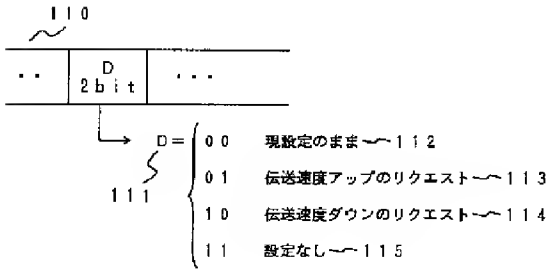
[Drawing 8]



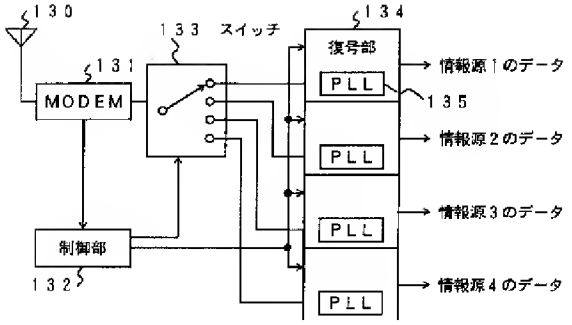
[Drawing 9]



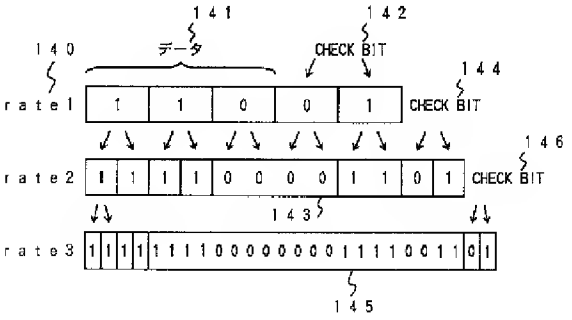
[Drawing 10]



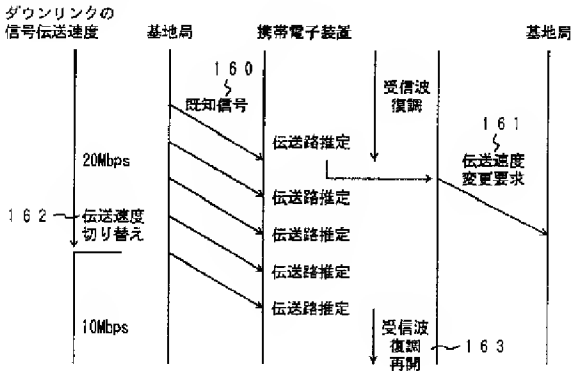
[Drawing 12]



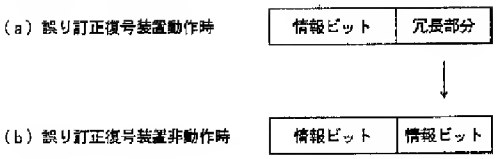
[Drawing 13]



[Drawing 15]



[Drawing 30]

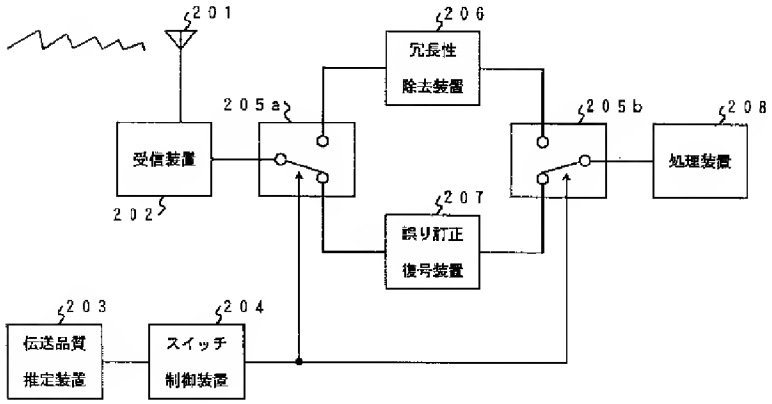


[Drawing 33]

変調パラメータの選択方法

C／N_0 の推定値x（dB）	使用変調パラメータ
x＜52.96	QPSK 8ksymbol/s
52.96≦x＜55.97	QPSK 16ksymbol/s
55.97≦x＜58.98	QPSK 32ksymbol/s
58.98≦x＜65.90	QPSK 64ksymbol/s
65.90≦x＜72.22	16QAM 64ksymbol/s
72.22≦x＜78.27	64QAM 64ksymbol/s
78.27≦x	256QAM 64ksymbol/s

[Drawing 16]



[Drawing 19]

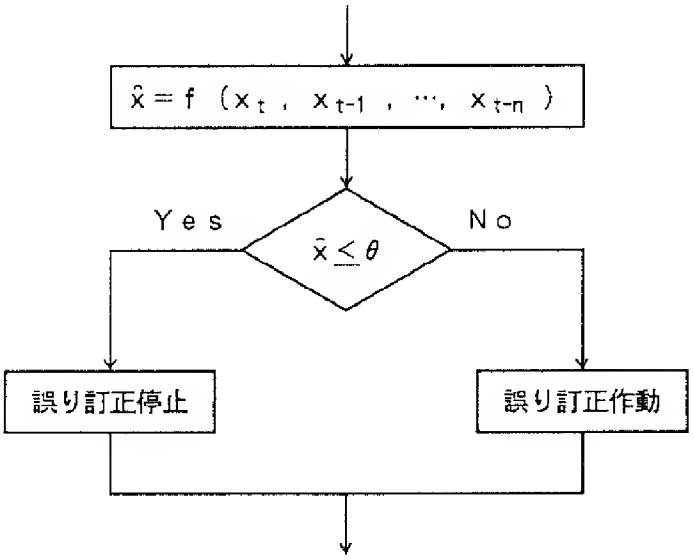
x_t ：時刻 t における伝送路品質の推定値（0～1）

θ ：しきい値（基準品質）

$\hat{x}$ ：慣性を加味した伝送品質の推定値

$f(x_t, x_{t-1}, \cdots, x_{t-n}) = \varepsilon_0 x_t + \varepsilon_1 x_{t-1} + \varepsilon_2 x_{t-2} + \cdots \varepsilon_n x_{t-n}$

ε_0 ， ε_1 ， …：重み係数（$1 \geq \varepsilon_0 > \varepsilon_1 > \cdots$）



[Drawing 20]

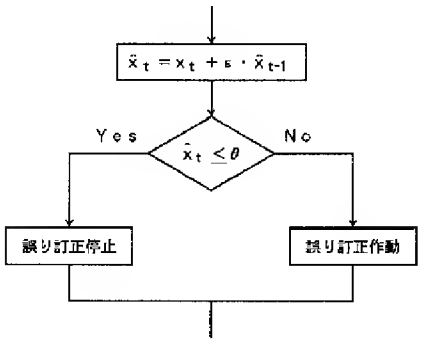
$$\begin{cases} \varepsilon_0 = 1 \\ \varepsilon_1 = \varepsilon \\ \quad \vdots \\ \varepsilon_n = \varepsilon^n \end{cases}$$

x_t ：時刻ｔにおける伝送路品質の推定値（０～１）

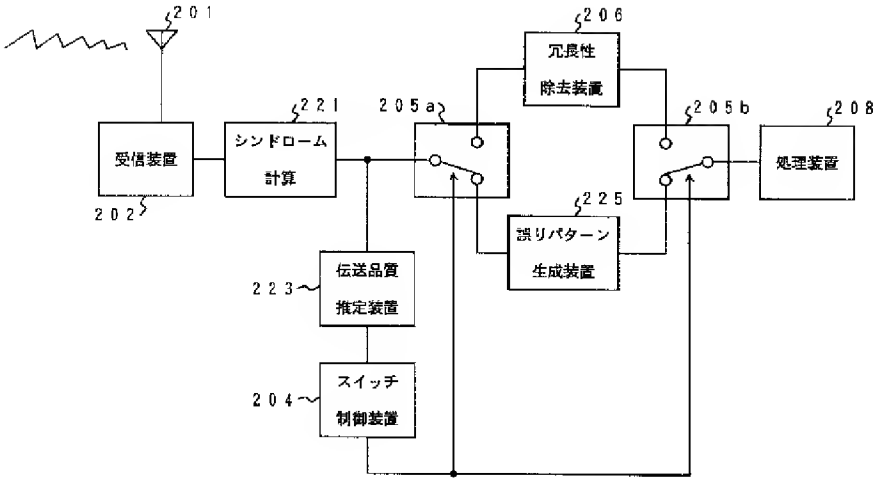
θ ：しきい値

$\tilde{x}_t$ ：時刻ｔにおける慣性を加味した伝送路品質の推定値（０～１）

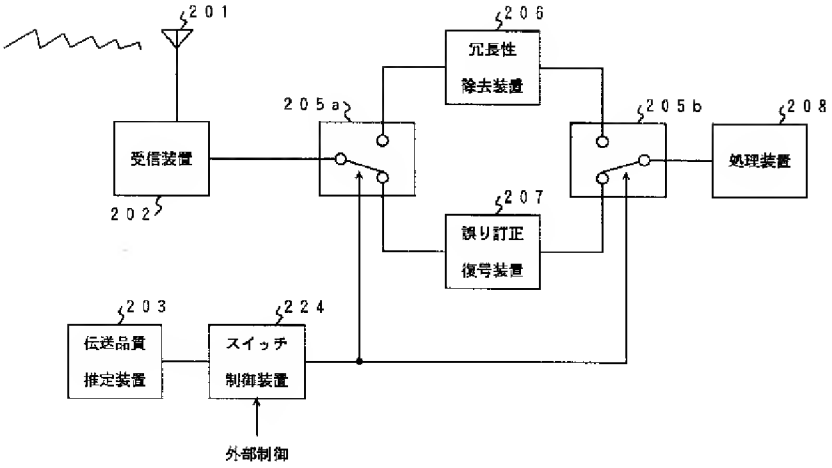
ε ：慣性値



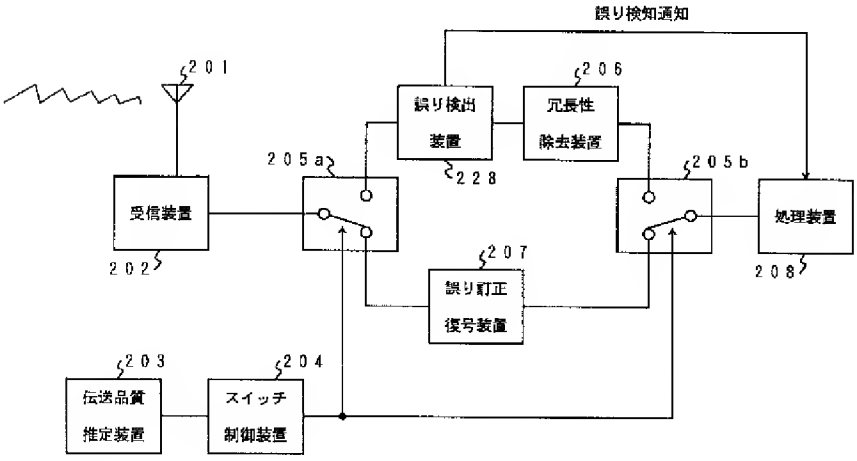
[Drawing 23]



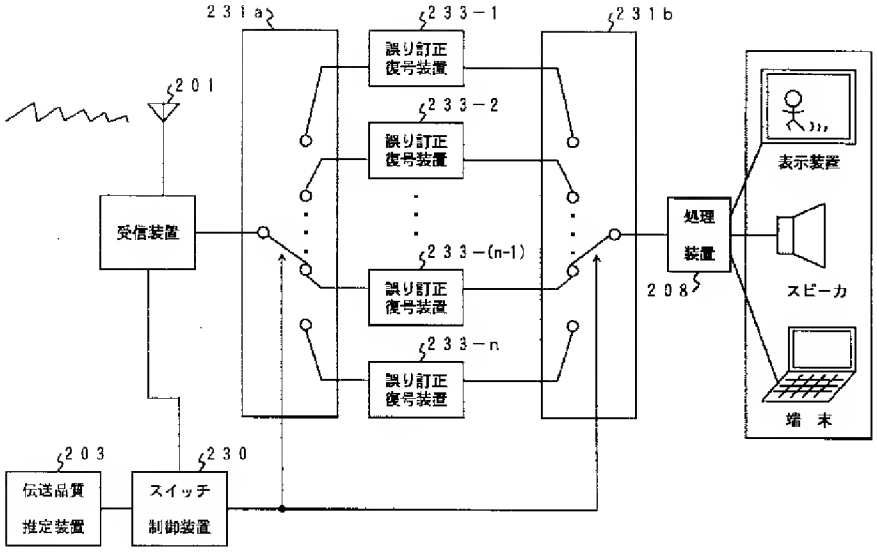
[Drawing 24]



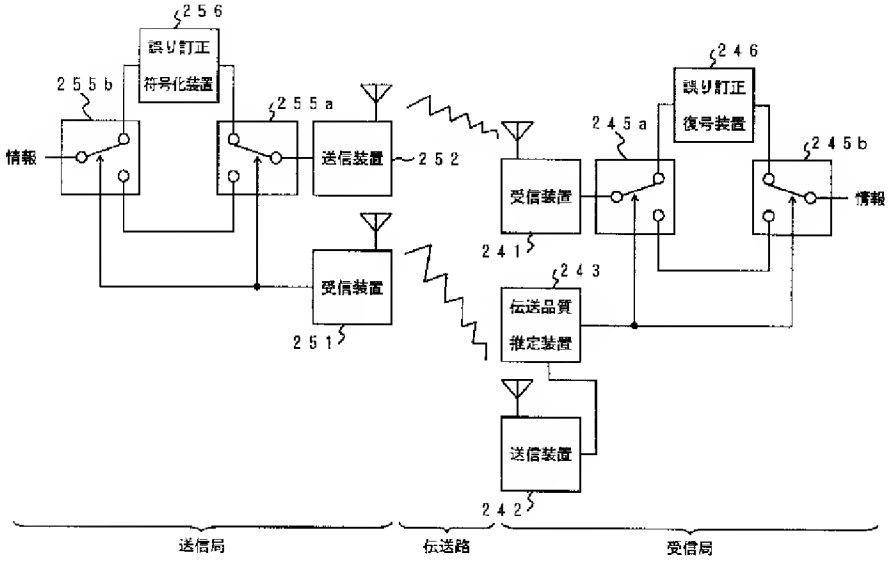
[Drawing 25]



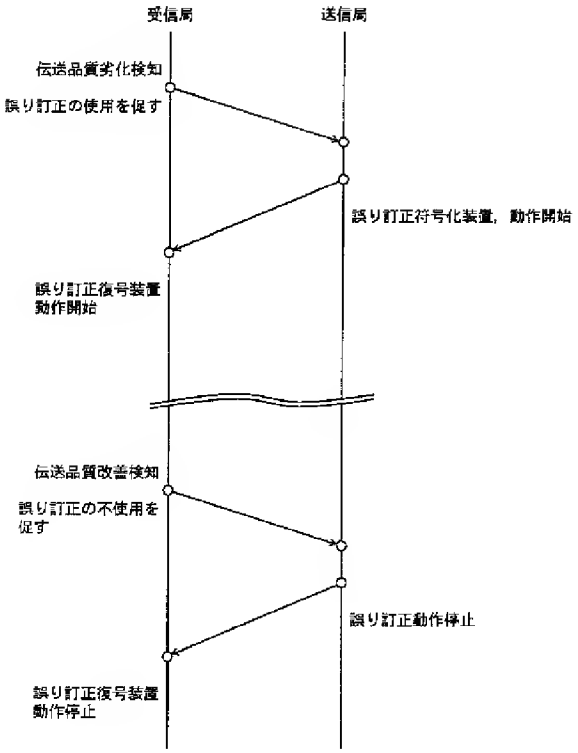
[Drawing 26]



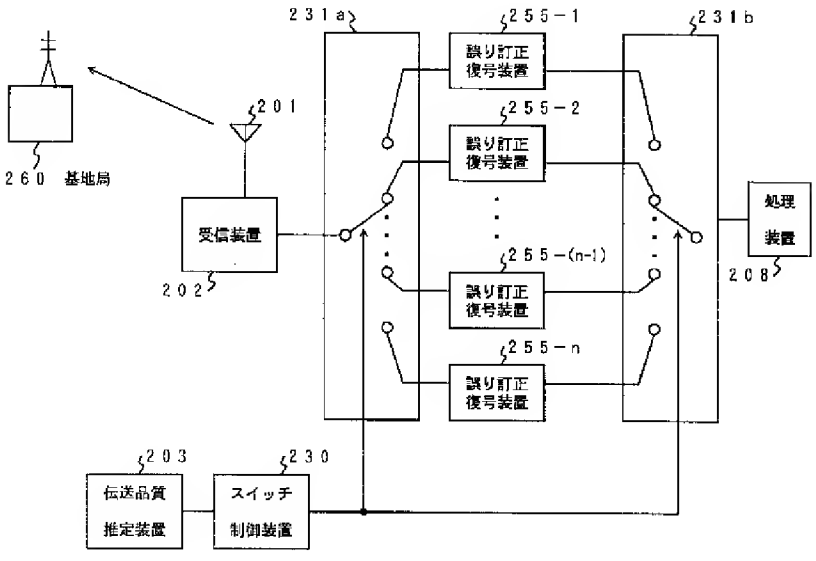
[Drawing 27]



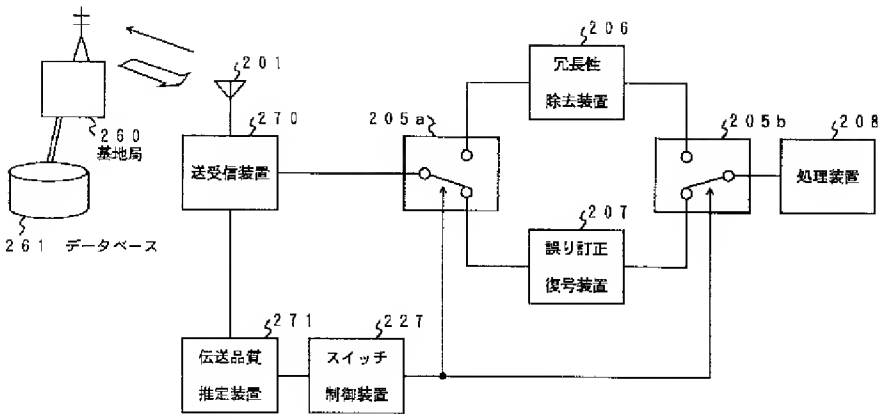
[Drawing 28]


受信局
送信局
伝送品質劣化検知
誤り訂正の使用を促す
誤り訂正符号化装置，動作開始
誤り訂正復号装置
動作開始
伝送品質改善検知
誤り訂正の不使用を
促す
誤り訂正動作停止
誤り訂正復号装置
動作停止

[Drawing 31]


231a
255－1
231b
誤り訂正
復号装置
255－2
誤り訂正
復号装置
201
260 基地局
受信装置
202
255－(n-1)
誤り訂正
復号装置
255－n
誤り訂正
復号装置
処理
装置
208
203
伝送品質
推定装置
230
スイッチ
制御装置

[Drawing 32]


201
260
基地局
261 データベース
270
送受信装置
205a
206
冗長性
除去装置
207
誤り訂正
復号装置
205b
208
処理装置
271
伝送品質
推定装置
227
スイッチ
制御装置